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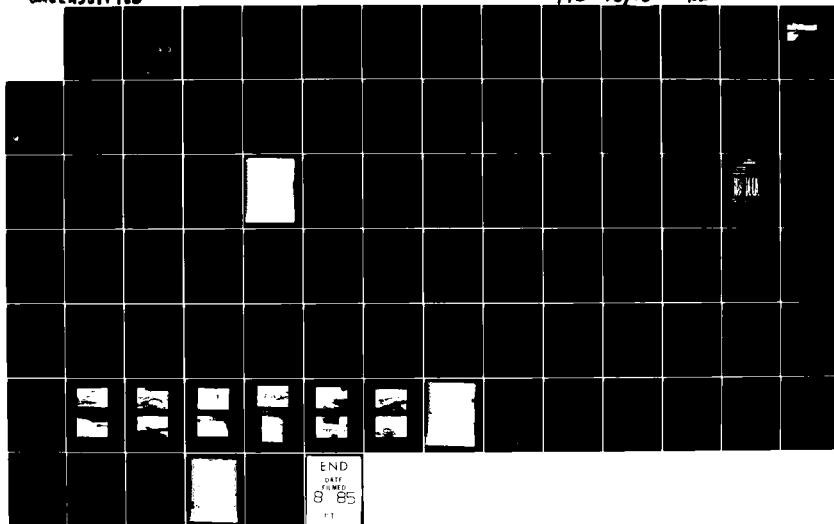
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MEETINGHOUSE POND DAM (U) CORPS OF ENGINEERS WALTHAM
MA NEW ENGLAND DIV NOV 78

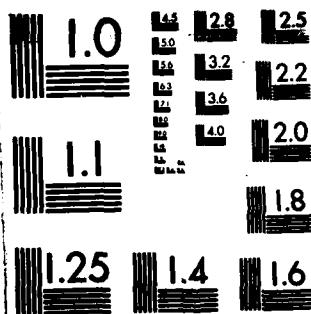
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MERRIMACK RIVER BASIN
WESTMINSTER, MASSACHUSETTS

MEETINGHOUSE POND DAM
MA 01018

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) The dam comprises two earthen embankments with an included spillway, The dam is about 230 ft. long and 15 ft. high. The dam is in good to fair condition. It was determined that the dike at the dike at the spillway was a crest elevation lower than the dam. Additional investigations are recommended to determine if the seepage is present at high water levels and to determine and modify as necessary freeboard.		

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DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM, MASSACHUSETTS 02154

REPLY TO
ATTENTION OF:

NEDED

JAN 9 1970

Honorable Edward J. King
Governor of the Commonwealth of
Massachusetts
State House
Boston, Massachusetts 02133

Dear Governor King:

I am forwarding to you a copy of the Meetinghouse Pond Dam Phase I Inspection Report, which was prepared under the National Program for Inspection of Non-Federal Dams. This report is presented for your use and is based upon a visual inspection, a review of the past performance and a brief hydrological study of the dam. A brief assessment is included at the beginning of the report. I have approved the report and support the findings and recommendations described in Section 7 and ask that you keep me informed of the actions taken to implement them. This follow-up action is a vitally important part of this program.

A copy of this report has been forwarded to the Department of Environmental Quality Engineering, the cooperating agency for the Commonwealth of Massachusetts. In addition, a copy of the report has also been furnished the owner, the City of Fitchburg, ATTN: Mr. Joseph Levanti, Commissioner of Public Works, 718 Main Street, Fitchburg, Massachusetts 01420.

Copies of this report will be made available to the public, upon request, by this office under the Freedom of Information Act. In the case of this report the release date will be thirty days from the date of this letter.

I wish to take this opportunity to thank you and the Department of Environmental Quality Engineering for your cooperation in carrying out this program.

Sincerely yours,

John P. Chandler
JOHN P. CHANDLER
Colonel, Corps of Engineers
Division Engineer

Incl
As stated

MEETINGHOUSE POND DAM
MA 01018

MERRIMACK RIVER BASIN
WESTMINSTER, MASSACHUSETTS

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

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**PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM**

Identification No.: MA 01018
Name of Dam: MEETINGHOUSE POND
Town: WESTMINSTER
County and State: WORCESTER COUNTY, MA
Stream: SMITH BROOK
Date of Inspection: 22 August 1978

BRIEF ASSESSMENT

Meetinghouse Pond Dam comprises two earthen embankments with an included spillway. The major embankment, the dam, is approximately 230 feet long and 15 feet high. The gate house and water intakes are located at this embankment. The dam was constructed on or about 1893 according to records obtained from the City of Fitchburg. The other embankment, the dike, is approximately 170 feet long and approximately 6 feet high. It is located to the north of the dam and includes a masonry spillway with wooden flashboards. Ledge outcrops are adjacent to the spillway and form a part of the spillway channel floor. No information was located pertaining to the date the spillway was constructed but it is assumed that it was built during the same time as the dam.

The dam is in good to fair condition. The reservoir water level was low during the site examination and, therefore, no true indication of seepage could be observed. It was determined that the dike at the spillway has a crest elevation lower than the dam. The crest of the dike and the adjacent terrain is so heavily covered with vegetation that low points may have been obscured.

Based on the size and hazard classification in accordance with the Corps of Engineers guidelines, the spillway test flood is the 1/2 Probable Maximum Flood (1/2 PMF). Hydraulic analyses indicate that the spillway can safely pass the test flood provided the flashboards are not in place; otherwise the spillway dike will be overtopped.

Recommendations for remedial work include the clearing of brush and trees from the dike, dam, spillway and discharge channel; the filling of animal burrows; the providing of additional riprap protection; the re-shaping of the dam crest to limit vehicle traffic; and performing maintenance work on the spillway and gate house. Additional investigations of the spillway dike are recommended to determine if seepage is present at high water.

levels and to determine and modify as necessary the freeboard. The investigations and remedial work be carried out by the Owner within two years of the receipt of this report.

CAMP DRESSER & MCKEE INC.

Roger H. Wood

Roger H. Wood
Vice-President



This Phase I Inspection Report on Meetinghouse Pond Dam has been reviewed by the undersigned Review Board members. In our opinion, the reported findings, conclusions, and recommendations are consistent with the Recommended Guidelines for Safety Inspection of Dams, and with good engineering judgment and practice, and is hereby submitted for approval.

Richard F. Doherty

RICHARD F. DOHERTY, MEMBER
Water Control Branch
Engineering Division

Carney M. Terzian

CARNEY M. TERZIAN, MEMBER
Design Branch
Engineering Division

Joseph A. McElroy

JOSEPH A. MCELROY, CHAIRMAN
Chief, NED Materials Testing Lab.
Foundations & Materials Branch
Engineering Division

APPROVAL RECOMMENDED:

Joe B. Fryar

JOE B. FRYAR
Chief, Engineering Division

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I Investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions be detected.

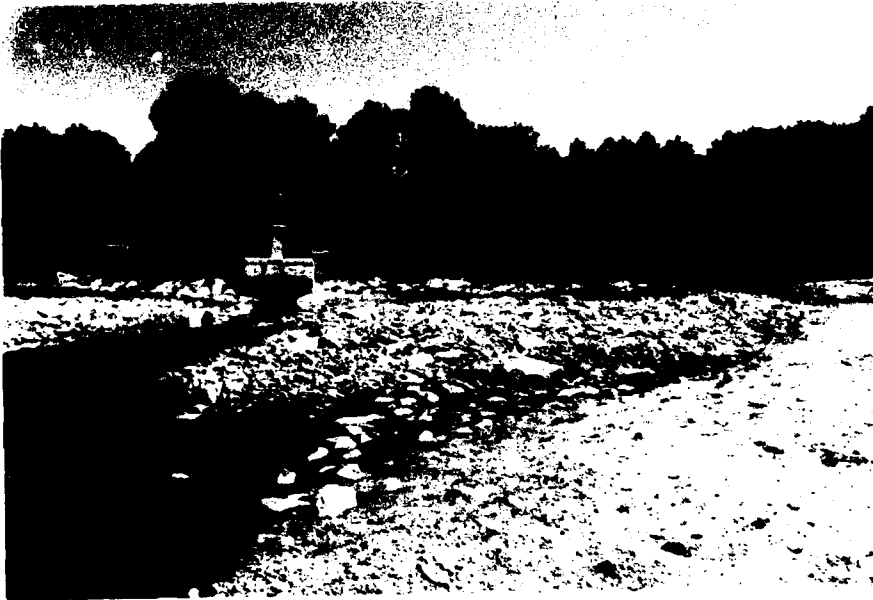
Phase I Investigations are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the test flood is based on the estimated "probable maximum flood" for the region (greatest reasonably possible storm runoff), or a fraction thereof. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the test flood should not be interpreted as necessarily posing a highly inadequate condition. The test flood provides a measure of relative spillway capacity and serves as an aide in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

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1. OVERVIEW OF MAIN DAM AND GATE HOUSE.



DAM: MEETINGHOUSE POND
IDENTIFICATION NO.: MA.01018



LOCATION MAP
USGS QUADRANGLE
GARDNER, MA.
SCALE: 1" = 2000'

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM
MEETINGHOUSE POND DAM
MA 01018

SECTION 1: PROJECT INFORMATION

1.1 General

- a. Authority - Public Law 92-367, August 8, 1972, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a national program of dam inspection throughout the United States. The New England Division of the Corps of Engineers has been assigned the responsibility of supervising the inspection of dams within the New England Region.

Camp Dresser & McKee Inc. has been retained by the New England Division to inspect and report on selected dams in the State of Massachusetts. Authorization and notice to proceed was issued to Camp Dresser & McKee Inc. under a letter of July 12, 1978, from Colonel John P. Chandler, Corps of Engineers. Contract No. DACW 33-78-C-0354 has been assigned by the Corps of Engineers for this work. Haley and Aldrich, Inc. has been retained by Camp Dresser & McKee Inc. for the soils and geological portions of the work.

- b. Purpose - The primary purpose of the investigation is to:
- (1) Perform technical inspection and evaluation of non-Federal dams to identify conditions which threaten the public safety and thus permit correction in a timely manner by non-Federal interests.
 - (2) Encourage and assist the States to initiate quickly effective dam safety programs for non-Federal dams.
 - (3) Update, verify and complete the National Inventory of Dams.

1.2 Description of Project

- a. Location - Meetinghouse Pond Dam and Spillway are located along the eastern shore of Meetinghouse Pond, in the Town of Westminster as shown on the report's Location Map. The spillway is located approximately 450 feet north of the dam and gatehouse, all of which are west of West Princeton Road. Meetinghouse Pond forms the headwaters of Smith Brook which flows in a southeasterly direction to Wyman Pond.

- b. Description of Dam and Appurtenances - Meetinghouse Pond Spillway consists of a relatively small earth embankment dike with an ungated concrete and rock spillway at the left end. There is also a separate larger earth embankment dam with a gate house structure at roughly the left one-third point. The total length of the dike is approximately 170 ft., including the spillway, while the dam is approximately 230 ft. long. Available plans and profiles obtained from the City of Fitchburg Department of Public Works, Engineering Division, and sketches prepared from inspection records are shown in Appendix B.

The dike embankment is approximately 6 ft. high and has a somewhat irregular cross section covered by trees and brush. The downstream slope appears to be on the order of 2 horizontal to 1 vertical. The crest has a pronounced slope down toward the pond, and the short upstream face is typically flatter than the downstream slope. There is riprap slope protection on the upstream face.

To the left of the spillway structure, the spillway wall backfill apparently merges with an area of natural ground that is close to the dike crest elevation. A low profile field stone wall, approximately 18-in. high and 50 feet long is located on top of the natural ground.

The dam embankment has the nearly parallel West Princeton Road embankment as part of its downstream slope, and has a maximum height of nearly 15 ft. relative to the roadway embankment toe. For most of its height, the upstream slope of the dam is approximately 2 to 1 while the downstream face has a wide horizontal step for the road and then a steep slope down to a stone masonry retaining wall. There is riprap slope protection in the form of rock slabs on the upstream face up to slightly above spillway crest elevation; most of the remaining slopes have a growth of either trees or brush.

The spillway consists of a grouted rubble apron approximately 30 feet long with training walls on either side which are 24'-6" apart. Approximately 24-in of flashboards are located across the 24'-6" wide crest which drops approximately 18-in to the downstream toe. Plan and sections of the spillway are shown in Appendix B.

The Pond's outlet consists of a long, narrow channel to the gate house on the dam embankment. Enclosed within the gate house is a mechanically cleaned bar screen which is located at the entrance to a 30-in diameter conduit which passes through the dam. On the downstream toe of the dam, the 30-in conduit connects to a 36-in conduit and a 20-in blow off pipe. The 20-in blow off has a gate valve and the 36-in conduit connects directly to the City of Fitchburg's water distribution system.

- c. Size Classification - The height of the dam is approximately 15 feet and the estimated total storage capacity at the top of the left spillway dike is 2,530 acre-feet. According to guidelines established by the Corps of Engineers, the dam is classified in the intermediated category based on the storage capacity.
- d. Hazard Classification - The dam was originally classified by the Corps of Engineers as having a "high" hazard potential. The results of the dam failure analysis indicate that a flood wave resulting from a failure of the right spillway embankment would cause damages to three roads and culverts and possibly some minor damage to 2 to 4 private residences along Patricia Road. Consequently, it is recommended that the hazard be reduced to significant.
- e. Ownership - The pond and dam are owned by the Fitchburg Water Department. The Owner's address is: Fitchburg Water Department, City Hall, 718 Main Street, Fitchburg, MA 01420 (Phone: 617/342-5722). The Superintendent of the Water Department, Mr. J. Andre Provencial, acted as the owner representative during this investigation.
- f. Operator - Operation of the dam is the responsibility of the Fitchburg Water Department. Mr. Norman Cormier is the Head Operator. Mr. Raymond Desjeans is the individual designated as the contact person. His address is: Water Shop, 78 River Street, Fitchburg, MA 01420 (Phone: 617/342-4212).
- g. Purpose of Dam - Meetinghouse Pond serves as a water supply reservoir for the City of Fitchburg.
- h. Design and Construction History - The dam was designed in 1893 and constructed shortly thereafter. No records of the construction are available. The gate house and spillway were repaired in 1968 by placing "qunite" over rubble and stone masonry. During recent times, a mechanical bar screen was installed in the gatehouse.
- i. Normal Operational Procedure - Water from Meetinghouse Pond is released by gravity feed through a mechanically cleaned bar screen located within the gate house and is conveyed through the dam via a 30" conduit. In the past, the water was discharged to Smith Brook which conveyed it to the Smith Distributing Reservoir and then via a 20" diameter conduit to the City's distribution system. Today, the water is fed directly into the distribution system via a 36" diameter conduit which is connected directly to the 30" conduit which passes through the dam. A gate valve, "Y" branch, and 25 ft. of 20" diameter blowoff pipe is located at the connection between the 30" and 36" diameter pipes. The 20" blow-off pipe discharges to the dry stream bed of Smith Brook.

A maximum of 6 MGD can be pumped into Meetinghouse Pond via a 16" and 20" force main from the Mare Meadow and Bickford Storage reservoirs.

1.3 Pertinent Data

Elevations given in this report are on National Geodetic Vertical Datum (NGVD) formerly referred to as Mean Sea Level (MSL).

a. Drainage Area - The 1.47 square mile watershed surrounding Meetinghouse Pond is sparsely developed and heavily wooded. The contour of the terrain is steep to rolling. The surface area of the pond (152.7 acres) represents approximately 16 percent of the drainage basin.

b. Discharge at Dam Site - There are no records of discharges at the dam site or for Smith Brook. Record Drawings of the dam and gatehouse report a "high water" elevation of 1,033.0 which corresponds to the spillway crest.

(1) Outlet conduit size 30" and Invert Elev. 1017.5.

(2) Maximum known flood at damsite _____ UNKNOWN

(3) Ungated spillway capacity at top of dam.
420 cfs @ 1,036.0 elev.

(4) Ungated spillway capacity at test flood pool elevation
350 cfs @ 1,035.6 elev.

(5) Gated spillway capacity at top of dam with flashboards
86 cfs @ 1,036.0 elev.

(6) Gated spillway capacity at test flood pool elevation with
flashboards 50 cfs @ 1,035.6 elev.

(7) Total spillway capacity at test flood pool elevation
350 cfs @ 1,035.6 elev.

(8) Total project discharge at test flood pool elevation
350 cfs @ 1,035.6 elev.

c. Elevation (ft. above MSL)

(1) Top of dam 1,037+; top of dikes at spillway 1,037 Rt. &
1,036 Lt.

(2) Test flood pool-design surcharge _____ 1,035.6

(3) Design surcharge-original design _____ UNKNOWN

(4) Full flood control pool _____ N/A

(5) Normal pool for water supply _____ 1,033

- (6) Spillway crest _____ 1,033.0
 (7) Upstream portal invert diversion tunnel _____ None
 (8) Streambed at centerline of dam _____ 1,022 (Est.)
 (9) Maximum tailwater _____ 1,031.1

d. Reservoir

- (1) Length of test flood _____ 5,300 feet (Est.)
 (2) Length of normal pool _____ 5,300 feet (Est.)
 (3) Length of flood control pool _____ N/A

e. Storage (acre-feet)

- (1) Top of left spillway dike _____ 2,530(Est.)
 (2) Test flood pool _____ 2,455(Est.)
 (3) Flood-control pool _____ N/A
 (4) Normal pool _____ 2,010 max.
 (5) Spillway crest _____ 2,010

f. Reservoir Surface (acres)

- (1) Top of left spillway dike _____ 170 (Est.)
 (2) Test flood pool _____ 168 (Est.)
 (3) Flood control pool _____ N/A
 (4) Normal pool _____ 152.7 max.
 (5) Spillway crest _____ 152.7

g. Embankments:

Dike

Dam

- | | | |
|---------------|--|---|
| (1) Type | Earth embankment | Earth embankment |
| (2) Length | Approx. 170 ft., incl.
Spillway | Approx. 230 ft. |
| (3) Height | Approx. 6 ft. | Approx. 15 ft. |
| (4) Top width | 24 to 30 ft., sloped
down toward pond | Approx. 25 ft.; road approx.
35 ft. additional |

- | | | | |
|-----|--------------------|--------------------------------|--|
| (5) | Side slopes | Approx. 3:1 U/S and
2:1 D/S | Approx. 2:1 U/S; irregular
with road and masonry wall
downstream |
| (6) | Zoning | Unknown | "Rolled earth" U/S and
D/S |
| (7) | Impervious
core | Unknown | "Rubble core wall laid in
cement" |
| (8) | Cutoff | Unknown | Unknown |
| (9) | Grout
curtain | Probably none | Probably none |

h. Diversion and Regulating Facilities -----None

i. Spillway

- (1) Type _____ Grouted Rubble Apron
- (2) Length of weir _____ 24'-6"
- (3) Crest elevation _____ 1,033.0; 1,035.0 with
flashboards
- (4) Gates _____ None
- (5) U/S channel _____ 9-ft. rise in 500 ft.
- (6) D/S channel _____ 9-ft. drop in 275 ft.
- (7) General _____ D/S channel overgrown
with vegetation

- j. Regulating Outlets - The reservoir drain and the water supply intake pipes at the dam gate house are the only regulating outlets for this reservoir. The intake channel is a fieldstone channel and extends out to the reservoir itself. Two 24-inch pipes connect the intake channel to the main chamber within the gate house. Both pipes are controlled by manually operated 24-inch gate valves. These gates are normally left in the open position. An electric powered, mechanically cleaned bar screen is contained within the main chamber. Leading from the main chamber is a 30-inch water supply pipeline also controlled by a 30-inch manually operated gate valve normally left in the open position. An old 10-inch pipeline controlled by a manually operated 10-inch gate valve extends from the main chamber downstream. This valve is normally left in the closed position. Downstream of the dam, there is a 20-inch blow-off on the 30-inch water supply line. This 20-inch blow-off**

pipe is controlled by a 20-inch gate valve. This line presently serves as the reservoir drain. The water supply pipeline is normally controlled by throttling the valves at the lower terminus of the line. All gates above this point, that is the gate at Meetinghouse Pond, are normally left in the open position. The invert elevation of the regulating outlets at Meetinghouse Pond is elevation 1,017.5

SECTION 2: ENGINEERING DATA

- 2.1 Design Records - The only design record located was a plan and section of the dam found in the files of the Department of Public Works, Engineering Division, Fitchburg, MA. A copy of this plan was also located at the Worcester County Engineering Department. No plans were located showing the original spillway configuration. A copy of a plan showing repair work on the gatehouse and spillway was also located at the Department of Public Works in Fitchburg, MA.
- 2.2 Construction Records - No records of the original construction were located.
- 2.3 Operation Records - No operational records are available other than reservoir water level readings.
- 2.4 Evaluation
 - a. Availability - Documents described above are available at the offices of the Public Works Department, Engineering Division, City of Fitchburg, MA.
 - b. Validity - The general configuration of the dam and gatehouse as shown in the 1893 plan of the dam is in good agreement with the configuration observed in the field. However, the intake channel and the downstream conditions are not in agreement with those shown on the plan. It must be assumed that modifications of the intake line and the repositioning of the adjacent highway took place at a later date.
 - c. Adequacy - While the available records provide useful information, the evaluation of the dam for the purpose of this investigation must be based primarily on the visual examination described in the following section.

SECTION 3: VISUAL INSPECTION

3.1 Findings

- a. General - The visual examination of the Meetinghouse Pond Dam and spillway was conducted on 22 August 1978. In general, the earth embankments, spillway and outlet facilities were observed to be in good to fair condition. The low water level in the reservoir precluded an examination for seepage and the heavy vegetation growth may have concealed problems.

Visual inspection checklists for both the dam and spillway locations are included in Appendix A and selected photographs are given in Appendix C.

- b. Dam - The earth embankments of the dam and dike are generally in fair condition. There is no visual evidence of lateral movement or seepage, or major settlement or erosion, but the heavy growth of brush and trees obscures much of the embankment surface. Also, the pond level was below the upstream toe of both the dam and dike at the time of inspection so that the possibility of seepage problems could not be evaluated. The following specific items were noted:

- (1) The dike has a heavy cover of brush and trees that limits visual observation of its condition, as shown in Photos 10 and 11.
- (2) The upstream riprap at the dike is partly concealed by brush, and does not appear to provide complete coverage on the slope.
- (3) There are at least three recently-used animal burrows in the downstream slope of the dike.
- (4) There appears to be a dip in the elevation of the dike crest near the right abutment, and there is an area in the woods to the left of the spillway where the highest ground is about a foot lower than the dike crest.
- (5) The dam has a cover of weeds, brush and young trees on its slopes above the riprap, and some weed growth between riprap stones, as shown in Photos 1, 2, 4 and 5. The slope downstream from West Princeton Road has large trees.
- (6) The upstream dam riprap is in generally good condition, although there are a few displaced slabs and there is evidence of several inches of surface settlement alongside

the Gate House foundation wall; there is also local slight erosion of the upstream slope immediately above the riprap.

- (7) Vehicle traffic has considerably rutted the crest of the dam.

The channel portion of the spillway and the spillway walls have been covered with shotcrete as shown in Photo Nos. 10, 12 and 13. The shotcrete is becoming loose and local areas have spalled off, especially at the left wall. The weir flashboards are in good condition but they are mis-aligned vertically and form an irregular crest as shown in Photo No. 11. As stated above, heavy brush is present on the adjacent dike and it overhangs the spillway. The entrance channel is essentially clear with only minor vegetation present. The discharge channel contains young trees and brush.

- c. Appurtenant Structures - The gate house shown in Photo Nos. 1 and 2 is in good condition. The wood trim on the structure requires maintenance and repainting. The parge coat at the base of the structure has some cracking present. The equipment shown in Photo Nos. 6 and 7 within the gate house, is operational with the exception of an abandoned 10-inch reservoir drain. All other valves within the structure are kept in the open position and the flow is controlled by valves at the downstream end of the pipeline. The blow-off valve and pipe shown in Photo Nos. 8 and 9, which are currently used as the reservoir drain, are operational. The field stone intake channel shown in Photo Nos. 1 and 3 was partially obscured by water but appeared to be in good condition.
- d. Reservoir Area - The area surrounding Meetinghouse Pond is heavily wooded and for the most part undeveloped. There is no existing development which would be affected by shoreline flooding at test flood pool elevation.

The side slopes to the pond are moderately steep. However, there is no significant potential for landslides into the pond which could create waves that might overtop the dam. No conditions were noted that could result in a sudden increase in sediment load into the pond.

- e. Downstream Channel - Smith Brook, which connects Meetinghouse Pond to Wyman Pond, was dry at the time of inspection and somewhat overgrown by brush immediately downstream of the dam site. This condition results from the lack of discharges from Meetinghouse Pond to Smith Brook as the pond is part of the City of Fitchburg's water supply system. Withdrawal from the pond is via a 36" diameter buried conduit which connects to the City's distribution system.

Approximately 275 feet downstream of the spillway is West Princeton Road and culvert. The stone arch box culvert is 36" wide and 45" high on the upstream face and is approximately 33 feet long. Top of road was estimated to be elevation 1,028.0 and the upstream invert of the culvert at elevation 1,020.75. In the event of an embankment failure, West Princeton Road would act as a secondary dam.

- 3.2 Evaluation - The Meetinghouse Pond dam and dike embankments appear to be performing satisfactorily at the present time. However, the apparent low areas at either end of the dike, the animal burrows on the downstream slope, and the possibility that other problems are concealed by heavy vegetation cover and low pond level at the time of inspection, could provide significant potential for dam or dike failure under conditions of higher than normal water levels. The gate house and spillway are in good condition. The wood trim on the gate house needs maintenance work and the spillway has some loose and spalled shotcrete. The spillway sidewalls are in fair condition. The shotcrete cover on the walls has become loose and contains a number of cracked and spalled areas.

SECTION 4: OPERATIONAL PROCEDURES

- 4.1 Procedures - In general there is no established routine for the operation of the dam other than those in effect for water supply purposes.
- 4.2 Maintenance of the Dam - The dam and spillway receive minimal maintenance. There is no established formal procedure for the maintenance of the dam. The present dam and spillway dike have become overgrown with tree and brush growth.
- 4.3 Maintenance of Operating Facilities - There is no formal procedure of maintenance of operating facilities. The mechanical bar screen is run at frequent intervals. The main portion of the gates within the structure are left in the open position. Maintenance is performed on the basis of need.
- 4.4 Description of any Warning System in Effect - There is no established warning system or emergency preparedness plan in effect for this structure.
- 4.5 Evaluation - Formal operational procedures, maintenance programs, warning systems and emergency preparedness plans should be established for this dam. The operational procedure should provide for the removal of flashboards during unusual discharges over the spillway. Periodic observations should be made at this dam and the tree and brush growth at the dam and spillway should be brought under control. Maintenance of the structures should be performed at regular intervals.

SECTION 5: HYDRAULIC/HYDROLOGIC

5.1 Evaluation of Features

- a. Design Data - No hydraulic/hydrologic design data are available concerning this dam other than the following information which appears on Data Plan of Water Works System, City of Fitchburg Water Department dated March 11, 1943.

Year Completed: 1893
Dam Elevation: 1,037.00
Spillway Elevation: 1,033.0
Area at Spillway Elevation: 152.70 acres
Capacity: 655.05×10^6 gallons
Draw: 15 feet
Greatest Depth: 45 feet
Watershed: 1.47 acres

Based upon the Corps of Engineers guidelines, the recommended test flood for the size (intermediate) and hazard potential (significant) is within the range of 1/2 PMF to PMF (Probable Maximum Flood). Since the size classification is at the lower end of the intermediate category and the hazard potential is considered to be at the lower end of the significant range as well, the 1/2 PMF shall be adopted as the test flood.

- b. Experience Data - The test flood was estimated using the Corps of Engineers Guidelines for Estimating Maximum Probable Discharges in Phase I Dam Safety Investigations. The watershed terrain was determined to be midway between Rolling and Mountainous and an inflow rate of 2,450 CSM was extrapolated for the drainage area of 1.47 square miles. This resulted in a test flood inflow of 1,800 cfs. Surge - storage routing was performed through Meeting-house Pond with the watersurface assumed to be at spillway crest (Elev. 1,033.0) at the beginning of the storm. The resulting test flood outflow was estimated to be 350 cfs.
- c. Visual Observations - The hydraulic condition of the spillway approach channel was observed to be in good condition. The flashboards consist of four 6-foot long sections. Each section contains three individual boards. Spaces were observed between each of the boards and between the bottom board and the spillway crest.

The discharge channel leading from the spillway to the stone arch culvert under West Princeton Road was overgrown with heavy vegetation which would significantly effect its hydraulic performance during periods of high discharge.

The natural embankment to the left of the spillway has a low profile wall made of field stone which is approximately 50 feet long. The top of this wall is about 3 feet above the spillway crest or approximately a foot lower than the right embankment.

- d. Overtopping Potential - The maximum capacity of the spillway with the pool elevation at the top of the left spillway embankment (Elev. 1,036.0) is 420 cfs. Since the test flood outflow was determined to be 350 cfs, the spillway is considered to be adequate.
- e. Evaluation - Embankment failure analysis was performed to determine the magnitude of downstream hazards in the event of such an occurrence. A peak failure outflow of 1,750 cfs was estimated based on a 40 percent breach width of the right spillway embankment. Field reconnaissance of the four culverts along Smith Brook between the dam site and Wyman Pond (West Princeton Road, unnamed road, Worcester Road - Rt. 140, and Patricia Road) indicate that each will be overtopped and the roadways could potentially be washed out. There is no existing development along Smith Brook which would be affected by a dam failure between the dam site and Patricia Road. Approximately 2 to 4 residential homes are located on Patricia Road which might experience some minor flooding in the event of a dam failure. Downstream of Patricia Road, the peak failure outflow would enter Wyman Pond which appears to have adequate capacity to attenuate the floodwave.

In conclusion, the Meetinghouse Pond spillway is adequate to pass the test flood and in the event of an embankment failure, damages would be limited to roads, culverts, and utilities with the potential for some minor flooding of 2 to 4 residences.

SECTION 6: STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

- a. Visual Observations - There was no visible evidence of dam or dike instability during the site examination on 22 August 1978. The 1975 State inspection report had noted ponded water and slight seepage at the downstream toe of the dike to the right of the spillway, but this condition would not have been evident during the site examination when the pond level was about 8 ft. below the dam crest.
- b. Design and Construction Data - The drawings obtained from the City of Fitchburg appear to show the basic cross section of the dam without the superimposed roadway embankment. However, there is no data on the physical properties of the material in the dam embankment, and there is substantially no design or construction information on the dike embankment.

The Meetinghouse Pond dike is relatively low, and, in the absence of significant seepage, the greater than 20 ft. top width and 2 horizontal to 1 vertical or flatter slopes would be expected to provide adequate stability under static loading conditions. Whether or not the previously reported seepage is significant has not been determined.

The dam is somewhat higher than the dike, but the adjacent roadway has considerably widened the embankment; the dam would be expected to be adequately stable under static loading conditions.

The only data on the spillway is a 1968 sketch plan for the shotcreting of the structure.

- c. Operating Records - There are no operating records for the dam other than reservoir water level readings.
- d. Post-Construction Changes - Without complete design or "as-built" drawings, it is not known if there have been post-construction changes to the embankments. Currently-active city records appear from available drawings to date from about 1964, indicating that the embankments have probably not had significant changes since that time. The shotcreting of the spillway is shown on a 1968 sketch plan.
- e. Seismic Stability - Meetinghouse Pond Dam is located in Seismic Zone No. 2 and in accordance with recommended Phase I guidelines does not warrant seismic analysis.

SECTION 7: ASSESSMENT, RECOMMENDATIONS AND REMEDIAL MEASURES

7.1 Dam Assessment

- a. Condition - The visual examination of Meetinghouse Pond Dam, including the dike, did not reveal any evidence of failure or conditions which would warrant urgent remedial treatment. The spillway was found to be adequate to pass the test flood. Because of the need for maintenance and additional investigation that is outlined hereinafter, the project is considered to be in good to fair condition.
- b. Adequacy of Information - Since there were only a few available drawings, nearly all of the information for the Phase I Investigation had to be obtained from visual examination and limited measurements at the site. This information has been sufficient for the purpose of this investigation, but it does not permit detailed evaluation of stability, seepage or available freeboard.
- c. Urgency - The recommended additional investigations and remedial measures outlined in Sections 7.2 and 7.3, respectively, should be undertaken within two years after receipt of this report by the Owner.
- d. Need for Additional Investigations - Additional investigations should be performed by the Owner as outlined in the following section.

7.2 Recommendations

It is recommended that the following additional investigations be performed by the Owner:

1. An investigation to determine whether or not the previously reported seepage at the toe of the dike embankment can have a significant effect on dike stability. As a first step this would require examination of the area under conditions of high water level in the pond.
2. Topographic survey and assessment of the dike embankment, including the left and right abutment areas, to permit evaluation of the actual dike configuration, particularly with respect to available freeboard.

7.3 Remedial Measures

a. Operation and Maintenance Procedures - It is recommended that the following remedial work be undertaken by the Owner, in addition to the investigations outlined in Section 7.2, to correct deficiencies noted during the visual examination:

- (1) Clear brush and trees from the dam and dike embankments, including stump removal and backfilling; establish vegetative cover; and cut grass and weeds on the embankments at least once a year. It would be reasonable to exclude the area downstream from West Princeton Road from the clearing requirement.
- (2) Provide additional riprap erosion protection where it is lacking or deficient on the upstream faces of the dam and dike.
- (3) Evict any occupants and fill the animal burrows in the downstream slope of the dike.
- (4) Re-shape the dam crest and limit vehicle traffic to avoid possible slope erosion by concentrated storm water runoff from ruts.
- (5) Remove and replace all loose shotcrete on the spillway structure.
- (6) Perform maintenance work on the gate house wood trim and the foundation parge coat.

Due to formerly reported seepage during high reservoir levels, it is recommended that during high reservoir levels and unusually heavy precipitation the Owner should provide surveillance of the embankments. The Owner should also develop a formal emergency procedures plan and warning system in cooperation with local officials in downstream communities. Finally, it is recommended that the owner establish a formal program of annual technical inspections.

VISUAL INSPECTION PARTY ORGANIZATION
NATIONAL DAM INSPECTION PROGRAM

DAM: Meetinghouse Dam

DATE: August 22, 1978

TIME: 1:00 p.m.

WEATHER: Clear-Calm-75-80°F

Down 4.75' from spillway
El. 1028 - Fitchburg Datum

WATER SURFACE ELEVATION UPSTREAM: _____

STREAM FLOW: No spillage or seepage

INSPECTION PARTY:

1. Roger H. Wood
 2. Joseph E. Downing
 3. Charles E. Fuller
 4. Peter LeCount - Haley & Aldrich
 5. _____
 6. _____
- } CDM

PRESENT DURING INSPECTION:

1. Andy Provencial, Water Supt.
2. Ernie Cormier, Operator
3. _____
4. _____

**VISUAL INSPECTION CHECK LIST
NATIONAL DAM INSPECTION PROGRAM**

DAM: Meetinghouse Pond

DATE: 8/22/78

EMBANKMENT: Dike at Spillway

CHECK LIST	CONDITION
1. Upstream Slope a. Vegetation b. Sloughing or Erosion c. Rock Slope Protection - Riprap Failures d. Animal Burrows	1. a. Brush, brambles, weeds b. Not evident c. Scattered riprap in brush d. None observed
2. Crest a. Vegetation b. Sloughing or Erosion c. Surface cracks d. Movement or Settlement	2. a. Brush, brambles, young trees b. Not evident c. Not evident d. Not evident, slope toward pond
3. Downstream Slope a. Vegetation b. Sloughing or Erosion c. Surface cracks d. Animal Burrows e. Movement or Cracking near toe f. Unusual Embankment or Downstream Seepage g. Piping or Boils h. Foundation Drainage Features i. Toe Drains	3. a. Brush, brambles, trees to 5" dia. (typ. 1-1/2" dia.) b. None observed c. None observed d. Three animal burrows, each approx. 5" dia. e. None observed f. None observed (ground damp @ toe but no water observed-pond 4.75' below spillway crest) g. None observed h. None observed i. None observed
4. General a. Lateral Movement b. Vertical Alignment c. Horizontal Alignment d. Condition at Abutments and at Structures e. Indications of Movement of Structural Items f. Trespassing g. Instrumentation Systems	4. a., b., c. Embankment obscured by growth, seems irreg. but no indication of movement. d. Seems low near right abut. & low area (1.5') behind stone wall between spillway & left abutment. e. Spillway gunite cracked, but no indication of significant movement. f. None evident g. None evident

VISUAL INSPECTION CHECK LIST
NATIONAL DAM INSPECTION PROGRAM

DAM: Meetinghouse Pond

DATE: 8/22/78

EMBANKMENT: Dam

CHECK LIST	CONDITION
1. Upstream Slope a. Vegetation b. Sloughing or Erosion c. Rock Slope Protection - Riprap Failures d. Animal Burrows	1. a. Weeds, brush, young trees (1-2" dia.) b. Local slight erosion above riprap (\approx 6") c. Slab riprap generally good, slight settlement along side gate house. d. None observed
2. Crest a. Vegetation b. Sloughing or Erosion c. Surface cracks d. Movement or Settlement	2. a. Weeds & grass along gravel roadway. b. Slight rutting in gravel c. None evident d. None evident
3. Downstream Slope a. Vegetation b. Sloughing or Erosion c. Surface cracks d. Animal Burrows e. Movement or Cracking near toe f. Unusual Embankment or Downstream Seepage g. Piping or Boils h. Foundation Drainage Features i. Toe Drains	3. a. Weeds & brush between road & dam, brush & trees (up to 24" dia.) downstream from road. b. None evident c. None evident d. None observed e. None evident f. None evident g. None evident h. None evident i. None evident
4. General a. Lateral Movement b. Vertical Alignment c. Horizontal Alignment d. Condition at Abutments and at Structures e. Indications of Movement of Structural Items f. Trespassing g. Instrumentation Systems	4. a., b., c. Dam somewhat irregular, but no indication of movement. d. Dam grades into earth & rock @ abutments, apparent 1-4" settlement alongside gate house. e. None observed f. Vehicle traffic on dike g. None evident

VISUAL INSPECTION CHECK LIST
NATIONAL DAM INSPECTION PROGRAM

DAM: Meetinghouse

DATE: 8-22-78

SPILLWAY: _____

CHECK LIST	CONDITION
1. Approach Channel a. General Condition b. Obstructions c. Log Boom etc.	1.a. Good-natural ground to shotcreted ledge-shotcrete becoming loose. b. Minor vegetation-grass, weeds. c. None
2. Weir a. Flashboards b. Weir Elev. Control (Gate) c. Vegetation d. Seepage or Efflorescence e. Rust or Stains f. Cracks g. Condition of Joints h. Spalls, Voids or Erosion i. Visible Reinforcement j. General Struct. Condition	2.a. Good-misaligned vertically. b. No gate c. Grass & weeds adjacent d. None observed e. None observed f. Some cracks g. None observed h. Some areas rounded-loose i. None j. Good
3. Discharge Channel a. Apron b. Stilling Basin c. Channel Floor d. Vegetation e. Seepage f. Obstructions g. General Struct. Condition	3.a. Shotcrete over ledge b. None c. Natural ground d. Young trees & brush downstream e. None observed-reservoir low f. Vegetation g. Good
4. Walls a. Wall Location <u>Rt & Lt</u> (1) Vegetation (2) Seepage or Efflorescence (3) Rust or Stains (4) Cracks (5) Condition of Joints (6) Spalls, Voids or Erosion (7) Visible Reinforcement (8) General Struct. Condition	4 a. (1) Trees overhanging. Some weed growth (2) None observed (3) None observed (4) Cracks present in surface especially left wall. (5) No joints (6) Shotcrete surface starting to spall especially left wall. (7) None (8) Left wall fair, right wall fair.

VISUAL INSPECTION CHECK LIST
NATIONAL DAM INSPECTION PROGRAM

DAM: Meetinghouse

DATE: 8-22-78

OUTLET WORKS: _____

CHECK LIST	CONDITION
1. Inlet a. Obstructions b. Channel c. Structure d. Screens e. Stop Logs f. Gates	1.a. None observed b. Field stone channel underwater-good c. None d. None e. None observed f. None observed
2. Control Facility a. Structure b. Screens c. Stop Logs d. Gates e. Conduit f. Seepage or Leaks	2.a. Wood trim needs repainting. Concrete base has been parged-some cracking present. b. Mechanically cleaned bar screen-good condition. c. None observed d. 1-30", 2-24", & 1-10" valves. Both 24" and 30" valves in open position. 10" drain valve is old. Estimated to be inoperable. See also 3e. e. Outlet is 30" pipe f. Not visible
3. Outlet a. Structure b. Erosion or Cavitation c. Obstructions d. Seepage or Leaks e. Gate	3.a. None b. Not visible c. None observed d. None observed e. 20" gate valve & blow off downstream of dam, operable & in good condition. Blowoff is off of 30" pipe.
4. Mechanical and Electrical a. Crane Hoist b. Hydraulic System c. Service Power d. Emergency Power e. Lighting f. Lightning Protection	4.a. None b. None observed c. Ok. d. None observed e. None observed f. None observed

VISUAL INSPECTION CHECK LIST
NATIONAL DAM INSPECTION PROGRAM

DAM: Meetinghouse Pond

DATE: August 22, 1978

HYDROLOGIC-HYDRAULIC CONSIDERATIONS: _____

CHECK LIST

CONDITION

1. Upstream Watershed
 - a. Type of Terrain
 - b. Hydrologic Controls

2. Reservoir
 - a. Type of Terrain
 - b. Development

3. Spillway
 - a. Adjacent Low Points
 - b. Spillway Approach (Slope)
 - c. Spillway Discharge (Slope)
 - d. Spillway Type

4. Downstream Watershed
 - a. Reach No. 1
 - (1) Control (Bridge, dam, culvert, etc.)
 - (2) Channel Characteristics
 - (3) Development
 - (4) Visible Utilities
 - (5) Special Problems (Hospital, etc.)

1. a. Rolling to steep @ watershed boundaries.
 b. No perennial streams tributary to pond per USGS map. Swampy area of 30+ acre @ SW end of pond. Development in watershed is sparse with less than 25 homes in tributary area.

2. a. & b. Same as above.

3. a. Gunited riprap spillway with 2" thick stoplogs 24" high. Approach is very flat (grouted riprap) while downstream channel is not well defined with drop of 11 ft. in 200' (5+ %) to West Princeton Rd. culvert.

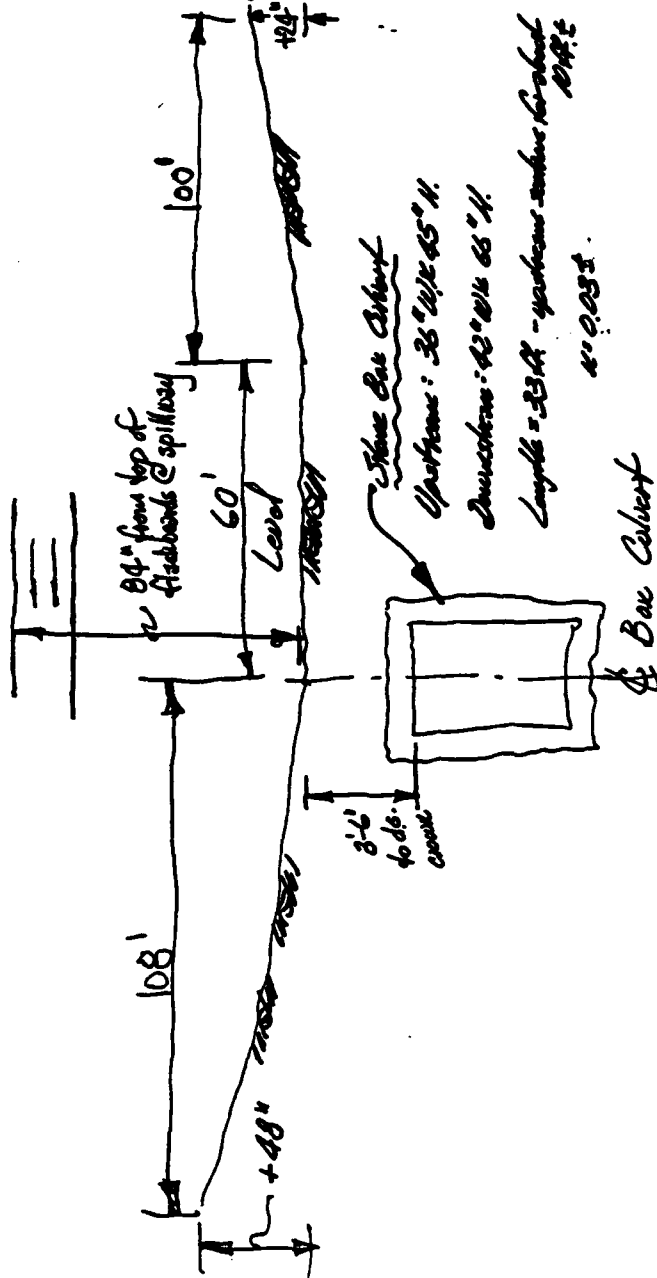
4. a. Reach No. 1
 - (1) W. Princeton Rd. culvert.
 - (2) Overgrown channel in ledge.
 - (3) None
 - (4) None
 - (5) None

CAMP DRESSER & MCKEE
Environmental Engineers
Boston, Mass.

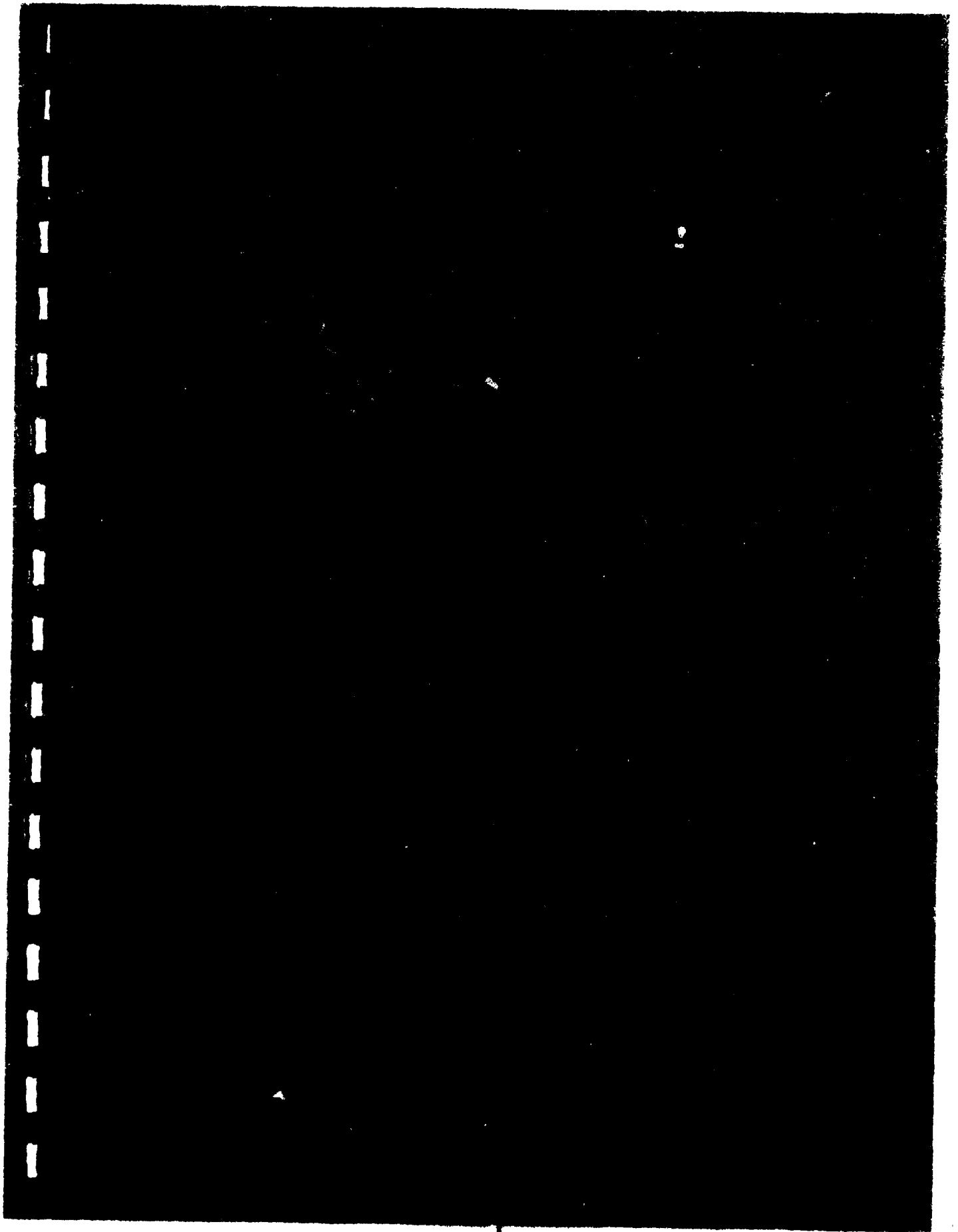
CLIENT _____
PROJECT _____
DETAIL Meetinghouse

JOB NO. _____
DATE CHECKED _____
CHECKED BY _____

PAGE _____
DATE _____
COMPUTED BY _____



WEST PRINCETON ROAD
WEIR PROFILE



LIST OF PLANS AND SKETCHES

MEETINGHOUSE POND DAM

DOCUMENT

1. Meetinghouse Reservoir

2. Land Plans

3. Location Map

CONTENTS

Location & Elevation of Flume

LOCATION

City of Fitchburg
Dept. of Public Works
Engineering Division
City Hall
718 Main Street
Fitchburg, MA 01420

Westminster Watershed System

Location of Reservoir
Watersheds, Principal Conduits,
Data Plan of Water Works System

City of Fitchburg Water Dept.
Department of Public Works
Engineering Division
City Hall
718 Main Street
Fitchburg, MA 01420

(Location of Documents No. 2 & 3)

TOWN OR CITY	WESTMINSTER	DECREE NO.	178	PLAN NO.	DAM NO. 59-194
LOCATION	Meeting House Pond	DESCRIPTION OF DAM	<i>E. 100' Laid in Rubble Core with Cement</i>		
Type	Earth	Name of Main Stream	<i>Meeting House Pond</i>		
Length	220'	" " any other Streams			
Height	14'	Length of Watershed			
Thickness top	20'	Width " "			
" bottom	70'	Is Watershed Cultivated			
Downstream Slope	1 1/2:1	Percent in Forests			
Upstream " "	2:1	Steepness of Slope			
Length of Spillway	15 in another section of dam: 20'	No. of Acres in Watershed	<i>191.34 152.</i>		
Size of Gates	1-10" Pipe & 1-30" Pipe outlet	" " " Reservoir			
Location of Gates	Gate House left center of dam	Length of Reservoir			
Flashboards used	Yes	Width " "			
Width Flashboards or Gates	20' "	Max Flow Cu. Ft. per Sec.			
Dam designed by	City Engineer	Head or Flashboards-Low Water			
" constructed by	" of Fitchburg	" " " High "			
Year constructed	1894	GENERAL REMARKS	<p><i>Docket #178. Mar. 1893 Meeting. Filed: June 14, 1893.</i></p> <p><i>Traced by: L. H. Saffy Feb. 14, 1936. Checked: Feb. 15 & 21, H. Spottford</i></p> <p><i>Attested by: William C. Bowen, C. of C. Feb. 21, 1936</i></p> <p><i>Inspected: Oct. 6, 1938 - L. H. Spottford</i></p> <p><i>Oct. 11, 1943 L.O.M.</i></p> <p><i>Aug. 22, 1960 " - Newmire L</i></p> <p><i>Dec. 21, 1948 " "</i></p>		
GENERAL REMARKS	<p><i>Owned by City of Fitchburg W.D.</i></p> <p><i>Vol. 28 P. 178. June 14, 1893</i></p> <p><i>March Meeting, 1893.</i></p> <p><i>Dec. 19, 1923, L.O. Marden</i></p> <p><i>2nd Inspection: May 24, 1926 - L.O. Marden</i></p> <p><i>12-16-28 " : Dec. 10, 1934 - " "</i></p> <p><i>Spillway is in natural ground about 1/2 mile from main embankment</i></p>				

inspector: Aug. 22, 1960 - Com. - Province

COUNTY OF WORCESTER, MASSACHUSETTS
OFFICE OF COUNTY ENGINEER

Neg. Nos.

INSPECTION OF DAMS, RESERVOIR DAMS AND RESERVOIRS

Town Westminster Date May 24, 1926 Dam No. 59-19

Location near E. Princeten Rd. Name of Pond or Stream Meetinghouse Pond

Inspected by L.O. Varden

Owner City of Fitchburg. Use Storage.

MATERIAL & TYPE For description see Note book 1 page 81.

Elevations in feet: above (+) or below (-) full pond or reservoir level.

FOR DAM Bed of stream below top of spillway

FOR RESERVOIR

top of dam top of flashboards ground surface below

level of overflow pipe length in feet

width top in feet width bottom in feet size pipe to mill

inches length spillway in feet head in feet

Size of wheel H. P. developed

Size of gates location of gates

Foundation and details of construction

condition of embankment

Constructed by date

Designed by location

Recent repairs and date

Evidence of leakage

Condition Dam in good condition

Topography of country below

Nature of buildings and roads below dam

No. Acres in watershed No. Acres in pond

Plans secured Percent watershed in cultivation

Percent in forests Note: Cross out word not applicable

COUNTY ENGINEER

Inspection of Dams, Reservoir Dams, and Reservoirs.

Inspected by L.O. Marden Date 12-16-28 Dam No. 59-12

Town WESTMINSTER Location

Owner Use

Material and Type

Dam Designed by Constructed by Year

SPILLWAY -LENGTH- 20'

El. top Abutment 100 El. Crest 97 El. Apron El. Streambed

Width top Abutment Width top Crest Width bottom Spillway

Width Flashboards carried 20" Kind Flashboards 2" plank

El. Flowline Cleanout Pipe none Size and Kind Cleanout Pipe none

Kind of Foundation under Spillway Ledge

Condition Cut out brush and stumps

EMBANKMENT

El. Top El. Natural Ground Width Top

Width of Bottom Upstream Slope Downstream Slope

Kind of Corewall Riprap relay where needed

Material in Embankment Foundation

Condition cut off brush

GATES Location

Size Kind El. Flowline

Condition

WHEEL Kind Size Rated H. P.

Location Ave. Head

Evidence of Leaks in Structure

Recent Repairs and Date

Topography of Country below Dam

Nature of Buildings and Roads below Dam

Number Acres in Pond Drainage Area in Square Miles

Discharge in Second Feet per Square Mile

Estimated Storage Million Cubic Feet

APPENDIX B-5

March 6, 1929.

59-19

City of Fitchburg Water Works,
Fitchburg, Mass.,
Attention Mr. Brown;-

Dear Mr. Brown;-

I recently made an inspection according to State
Law, of your dam at Lootinghouse Pond, in Westminster,
(out number 59-19), and found that ;

1. Brush and stumps should be cut out of spillway section.

Yours very truly,

County Engineer.

COUNTY OF WORCESTER MASSACHUSETTS

COUNTY ENGINEER

Inspection of Dams, Reservoir Dams, and Reservoirs.

Inspected by L.O. Marden Date 12-12-34 Dam No. 59-12

Town Westminster Location Meeting House Pond

Owner City of Fitchburg N.D. Use

Material and Type

Dam Designed by Constructed by Year

SPILLWAY—Length Feet Depth Feet

El. top Abutment El. Crest El. Apron El. Streambed

Width top Abutment Width top Crest Width bottom Spillway

Width Flashboards carried Kind Flashboards

El. Flowline Cleanout Pipe Size and Kind Cleanout Pipe

Kind of Foundation under Spillway

Condition O.K. clear out brush

EMBANKMENT—Length overall Feet

El. Top El. Natural Ground Width Top

Width of Bottom Upstream Slope Downstream Slope

Kind of Corewall Riprap

Material in Embankment Foundation

Condition cut off and grub out roots brush and small trees in rip rap

and top of embankment regrade slope and reset riprap next to gate house

GATES Location

Size Kind El. Flowline

Condition

WHEEL Kind Size Rated H. P.

Location Ave. Head

Evidence of Leaks in Structure none visible

Recent Repairs and Date none

Topography of Country below Dam

Nature of Buildings and Roads below Dam

Number of Acres in Pond Drainage Area in Square Miles APPENDIX B-7

Discharge in Second Feet per Square Mile

Estimated Storage Million Cubic Feet

Inspection of Dams, Reservoir Dams, and Reservoirs

Inspected by L. H. Spofford Date 10-8-38 Dam No. 59-19

Town Westminster Location Meeting House Pond

Owner City of Westminster Use Fitchburg Water Supply

Heavy cut granite water- with ledge apron 25' long x 3' high

SPILLWAY side walls. El. Crest El. Apron El. St. Bed

Width top Abut. Width top Crest Width bottom Sp. way

Width Flashboards Kind Flashboards

El. Flowline Cleanout Pipe Size and Kind Pipe

Kind of Foundation under Spillway

Condition Flashboards to the height of 2'1" are now in place and
apparently were there when the flood came. High water mark is 15"
above top of flashboards.

EMBANKMENT

El. Top El. Natural Ground Width Top

Width of Bottom Upstream Slope Downstream Slope

Kind of Corewall Riprap

Material in Embankment Foundation

Condition Embankment +100 ft. long is in good condition. Not topped
by flood.

GATES in gate house on dike Location

Size Kind El. Flowline

Condition

Incidence of Leaks in Structure Dike - also inspected dike. Everything
apparently in good condition there

Recent Repairs and Date

Number Acres in Pond Drainage Area in Sq. Miles

Discharge in Second Feet per Square Mile

Estimated Storage Million Cubic Feet

COUNTY ENGINEER

Inspection of Dams, Reservoir Dams, and Reservoirs.

Inspected by..... LOM..... Date..... Oct. 11, 1943 Dam No. 59-2

Town..... Westminster..... Location..... Meeting House Pond.....

Owner..... Use.....

Material and Type.....

Dam Designed by..... Constructed by..... Year.....

SPILLWAY

El. top Abutment..... El. Crest..... El. Apron..... El. Streambed.....

Width top Abutment..... Width top Crest..... Width bottom Spillway.....

Width Flashboards carried..... Kind Flashboards.....

El. Flowline Cleanout Pipe..... Size and Kind Cleanout Pipe.....

Kind of Foundation under Spillway.....

Condition..... appears O.K.

EMBANKMENT

El. Top..... El. Natural Ground..... Width Top.....

Width of Bottom..... Upstream Slope..... Downstream Slope.....

Kind of Corewall..... Riprap.....

Material in Embankment..... Foundation.....

Condition..... appears OK

GATES

Location.....

Size..... Kind..... El. Flowline.....

Condition..... appears OK.

WHEEL

Kind.....

Size.....

Rated H. P.....

Location..... Ave. Head.....

Evidence of Leaks in Structure.....

Recent Repairs and Date.....

Topography of Country below Dam.....

Nature of Buildings and Roads below Dam.....

Number Acres in Pond..... Drainage Area in Square Miles.....

Discharge in Second Feet per Square Mile.....

Storage in Million Cubic Feet.....

APPENDIX B-9

LOCATION _____

STREAM _____

WORCESTER COUNTY ENGINEERING DEPARTMENT
WORCESTER, MASSACHUSETTS

DAM INSPECTION REPORT

OWNED BY Fitchburg Water Dept PLACE Fitchburg USE Storage

INSPECTED BY LAM DATE Dec 21, 1998

TYPE OF DAM _____ CONDITION GOOD

SPILLWAY

FLASHBOARDS IN PLACE _____ RECENT REPAIRS _____

CONDITION _____

REPAIRS NEEDED _____

EMBANKMENT

RECENT REPAIRS _____

CONDITION _____

REPAIRS NEEDED _____

GATES

RECENT REPAIRS _____

CONDITION _____

REPAIRS NEEDED _____

LEAKS

HOW SERIOUS _____

DATE _____

COUNTY ENGINEER

APPENDIX B-10

TOWN Westminster

DAM NO. 59-19

LOCATION Mestery House Pond

STREAM _____

WORCESTER COUNTY ENGINEERING DEPARTMENT

WORCESTER, MASSACHUSETTS

DAM INSPECTION REPORT

OWNED BY City of Fitchburg

PLACE Fitchburg

USE water supply

INSPECTED BY Lm

DATE March 29, 1957

TYPE OF DAM _____

CONDITION _____

SPILLWAY

FLASHBOARDS IN PLACE _____

RECENT REPAIRS _____

CONDITION _____

REPAIRS NEEDED

OK - cut brush in channel

EMBANKMENT

RECENT REPAIRS _____

CONDITION _____

REPAIRS NEEDED

None - trim brush again

GATES

RECENT REPAIRS _____

CONDITION _____

REPAIRS NEEDED

None

LEAKS

HOW SERIOUS

None visible

DATE

March 29, 1957

APPENDIX B-11

L. A. Marden
COUNTY ENGINEER

TOWN Westminster

DAM NO. 59-19

LOCATION Meeting House Pond

STREAM _____

WORCESTER COUNTY ENGINEERING DEPARTMENT
WORCESTER, MASSACHUSETTS

D A M I N S P E C T I O N R E P O R T

Owned by City Fitchburg, W. D. Place Fitchburg Use water supply

Inspected by LOM Date March 4, 1958

Type of Dam stone spillway natural ground Condition Cut out brush

SPILLWAY

Flashboards in Place None Recent Repairs None

Condition Good

Repairs Needed Cut brush

EMBANKMENT

Recent Repairs None

Condition Has raised road downstream

Repairs Needed None

PILES

Recent Repairs None

Condition appear OK

Repairs Needed None

EAKS

How Serious None visible

DATE: March 4, 1958

APPENDIX B-12

LO Marden

TOWN Westminster DAM NO. Entered

LOCATION Meeting House Pond STREAM 59-19

Brook below pond shall be cleaned out:

WORCESTER COUNTY ENGINEERING DEPARTMENT
WORCESTER, MASSACHUSETTS

D A M I N S P E C T I O N R E P O R T

Owned by City of Fitchburg Place Fitchburg Use

Inspected by L.O.M. A. Provincial Date Aug. 22, 1960

Type of Dam Condition

SPILLWAY

Flashboards in Place None Recent Repairs

Condition Some brush in stone spillway channel

Repairs Needed Get out brush & remove roots

EMBANKMENT

Recent Repairs none

Condition Some brush on Embankment

Repairs Needed cut brush - grub out roots and fill
holes with loam, tamp in place and seed
Rip rap in poor condition.

GATES

Recent Repairs gates locked - could not inspect - in gate house

Condition Provincial said condition fair to good

Repairs Needed Place in A No. one working order

LEAKS

How Serious No leaks visible

DATE: Aug. 25, 1960 P. O. Marder County Engineer

LOCATION

West Princeton Rd.

STREAM

Maatinghouse Brook"Maatinghouse Pond"WORCESTER COUNTY ENGINEERING DEPARTMENT
WORCESTER, MASSACHUSETTSDAM INSPECTION REPORT

Owned by

City of Fitchburg

Place

Water Dept.

Use

Water Supply

Inspected by

W.H.L.

Date

Oct. 27 1964

Type of Dam

Earth and cut stone

Condition

GoodSPILLWAY

Flashboards in Place

20" of boards

Recent Repairs

Condition

The spillway area is 24' x 35'. The granite stone

Repairs Needed

crest is located on ledge. The abutment walls are concrete stone. This spillway is divided into 4 panels with steel uprights. The inletEMBANKMENT

Recent Repairs

and outlet channel is partly blocked with brush.

Condition

The embankment is covered with brush.

Repairs Needed

GATES

Recent Repairs

The gate is located in a locked brick gate house

Condition

Repairs Needed

LAKE

Serious

E:

County Engineer

APPENDIX B-14

TOWN Westminster DAM NO. 59-19

LOCATION NW side of W. Princeton Rd. STREAM (Meetinghouse) Brook

"Meetinghouse Pond"

WORCESTER COUNTY ENGINEERING DEPARTMENT
WORCESTER, MASSACHUSETTS

DAM INSPECTION REPORT

Owned by City of Fitchburg Place Water Dept. Use Water Supply

Inspected by WOL Date May 18, 1966

Type of Dam Earth - Stone - Concrete Condition Good

SPILLWAY

Flashboards in Place 18" of boards Recent Repairs _____

Condition Outlet channel is covered with brush.

Repairs Needed Granite stone crest - cemented stone abut. walls - successful design board supports can also be used for walkway supports.

EMBANKMENT

Recent Repairs _____

Condition Embankment at Gate House is good.

Repairs Needed Present water level is down 4' 2" below spillway crest.

GATES

Recent Repairs _____

Condition Brick Gate House is good.

Repairs Needed _____

LEAKS

Leak Serious No leaks visible.

By: _____ County Engineer

APPENDIX B-15

TOWN Westminster DAM NO. 59-19
LOCATION Wly (200') of W. Princeton Rd. STREAM "Meatinghouse Pond"

WORCESTER COUNTY ENGINEERING DEPARTMENT
WORCESTER, MASSACHUSETTS

DAM INSPECTION REPORT

Owned by City of Fitchburg Place Water Dept. Use Water Supply
Inspected by WOL Date Oct. 21, 1966
Type of Dam Earth - Stone - Concrete Condition Good - to Fair

SPILLWAY

Flashboards in Place 20" of boards Recent Repairs _____
Condition Recent cement work (patching) has been done on crest
Repairs Needed and new pins installed to hold granite crest stones in place
Abutment outlet should be cleared of brush.

ABUTMENT

Recent Repairs _____
Condition Abutment at spillway location is covered with brush
Repairs Needed " gate " " good

GATES

Recent Repairs _____
Condition Gate looks good - stone inlet channel to gate
Repairs Needed house shows on crest low water level in pond

LAKE

Serious _____

E: _____ County Engineer

LOCATION Westminster DAM NO. 59-19A
West Princeton Rd. STREAM Meetinghouse Pond Brook

"Meetinghouse Pond"
WORCESTER COUNTY ENGINEERING DEPARTMENT
WORCESTER, MASSACHUSETTS

DAM INSPECTION REPORT

Owned by City of Fitchburg Place Water Dept. Use Water Supply
Reported by W.O.L. Date Sept 1968
Type of Dam Earth-stone-concrete Condition Good

SPILLWAY

Boards in Place 2' of boards in place Recent Repairs _____
Condition Eastern Concrete Co. is now completing the guniting of the
Repairs Needed abutment walls and the spillway crest.
outlet channel has been cleared of all brush and debris.

EMBANKMENT

Repairs The water level is down about 5' below the top of
Condition the boards.
Repairs Needed The brush on the embankment has been cut

S

Repairs _____
Condition _____
Repairs Needed _____

US

ious _____

County Engineer
APPENDIX B-17

TOWN

1. Huntington

DAM NO.

Meetinghouse Reservoir
59-19

LOCATION

STREAM

WORCESTER COUNTY ENGINEERING DEPARTMENT
WORCESTER, MASSACHUSETTSDAM INSPECTION REPORT

Owned by

City of Fitchburg

Place

Use

Inspected by

T.C.M. - M.B.R.

Date

3-13-69

Type of Dam

Condition

SPILLWAYWater level normal - being watched by City

Flashboards in Place

Recent Repairs

Condition

Repairs Needed

EMBANKMENT

Recent Repairs

Condition

Repairs Needed

UTES

Recent Repairs

Condition

Repairs Needed

LEAKS

APPENDIX B-18

How Serious

DATE:

County Engineer

Is Address: Public Works - Water Dept.
Function of Dam: Water Supply

Stream: Meetinghouse Brook
Pond: Meetinghouse Pond
Date: 2-23-72
By: Eaton & Cony
CONDITION RATING
Structural: Good
Hydraulic: 24' x 4'
General: Good
PRIORITY: *

Location & Access: Off West Princeton Rd.
0.15 Mile West of Rte. 140 Intersection
USGS Quad. Gardner 19c Lat. 42-32-00 Long. 71-54-15
Drain. Ar.: 191 Sq. Mi.; Ponds: ac.; Res. @ dam: 1530
Character of D.A.:

Estimated
Discharge:
Capacity:

General Description of Dam and Discharge Control:

Rip rapped earth dam with gunited stone spillway 24' wide
2' of boards in place + stone walls are 2' additional feet higher
No gate at this location

Sketch (Not to Scale):



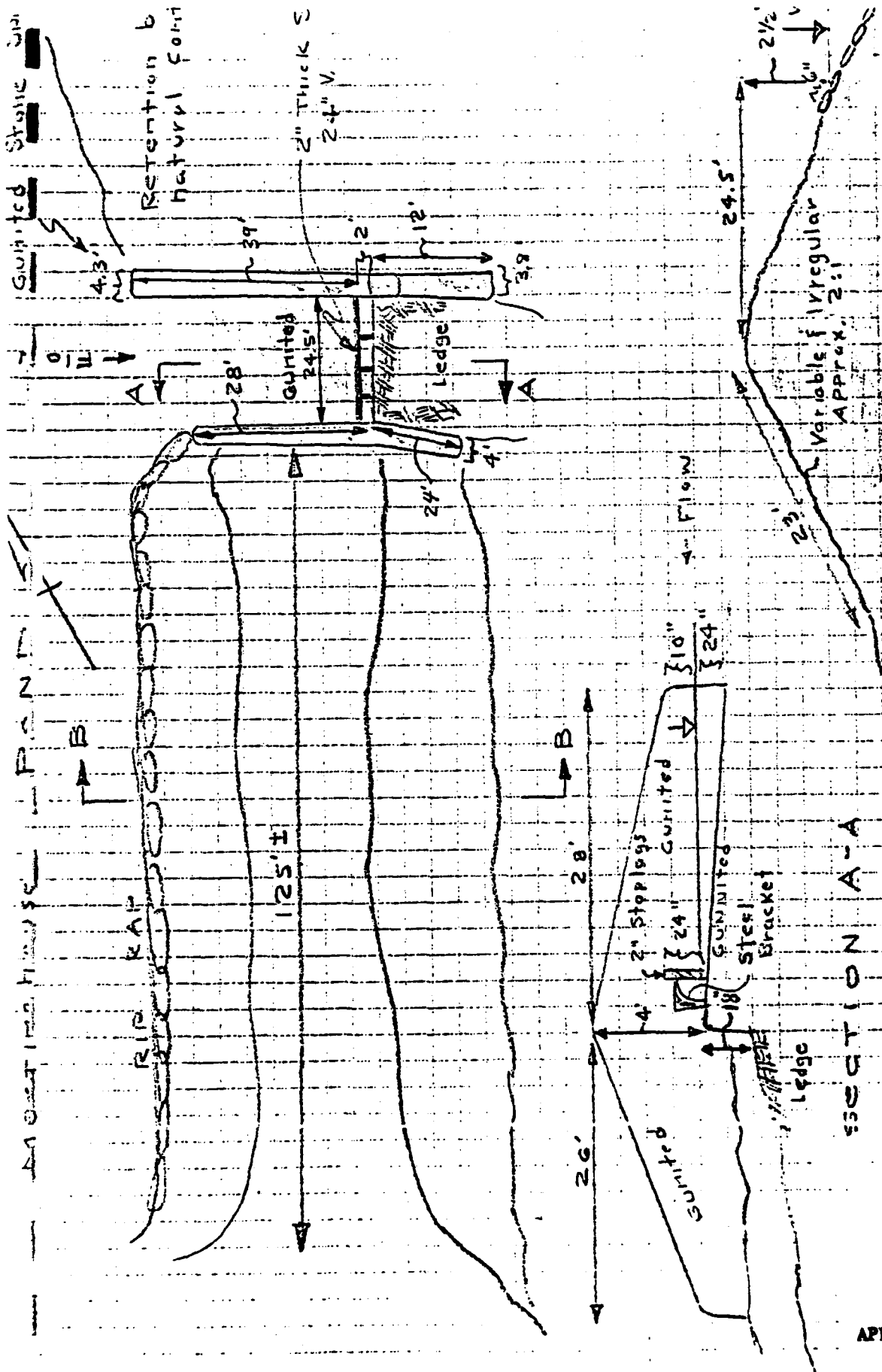
Remarks and Recommendations:

* Brush on dam should be cut

Date 2-23-72 By Eaton & Cony Comment

Dam No. 3-14-332-19

APPENDIX B-19



WESTMINSTER
MEETINGHOUSE POND
DAM No. 3.14-332-19

1. Location: ~~City/Town~~ WESTMINSTER Dam No. 517-5201
Name of Dam Meetinghouse Pond Inspected by REGAN RIZKALLA
Date of Inspection 5/14/75

2. Owner/s: per: Assessors _____ Prev. Inspection _____
Reg. of Deeds _____ Pers. Contact ✓

1. The Hon. Hedley Bray - Mayor - City Hall - 718 Main St. Fitchburg Mass.
Name _____ St. & No. _____ City/Town State Tel. No. _____

2. George LANIDES, Public Works Commissioner & City Engineer - City Hall
Name _____ St. & No. _____ City/Town State Tel. No. _____

3. _____
Name _____ St. & No. _____ City/Town State Tel. No. _____

3. Caretaker (if any) e.g. superintendent, plant manager, appointed by absentee owner, appointed by multi owners.

Name: _____ St. & No.: _____
City/Town: _____ State: _____ Tel. No.: _____

4. No. of Pictures taken _____

5. Degree of Hazard: (if dam should fail completely)*

1. Minor _____ 2. Moderate ✓ _____
3. Severe _____ 4. Disastrous _____

* This rating may change as land use changes (future development)

6. Outlet Control: Automatic _____ Manual ✓ _____
Operative ✓ yes; _____ No.

Comments: Isolated Gate house located on Shore 450'± W. of
This dam

7. Upstream Face of Dam: Conditions:

1. Good _____ 2. Minor Repairs ✓ _____
3. Major Repairs _____ 4. Urgent Repairs _____

8. Comments: ① Remove Trees & brush
② Augment Slope Protection (more RIP RAP needed on
Face)

1. Downstream Face of Dam:

Condition: 1. Good _____ 2. Minor Repairs ✓
3. Major Repairs To ✓ 4. Urgent Repairs _____

Comments: ① Remove Trees & brush. ② 1 Animal Burrow noted
③ 12" wide x 1" deep x 25' long Pool of standing water
15' W. of Spillway (From d.s. To To d.s. Brook). No Flow Visible
Principal ON day of inspection
Emergency Spillway

Condition: 1. Good _____ 2. Minor Repairs ✓
3. Major Repairs To ✓ 4. Urgent Repairs _____

Comments: GUNITE ON Stone masonry is failing. This is very seep
pronounced at the U.S. Spillway Floor. Very little water was flowing
over the spillway crest, and there was a trickle flow emerging from the
d.s. To of the Vert. 18" Wier Face

2. Water Level at time of inspection: 2.5 ft. above ✓ below _____
top of dam Emb. principal spillway _____
other ① Spillway Invert

3. Summary of Deficiencies Noted:

Growth (Trees and Brush) on Embankment ✓

Animal Burrows and Washouts 1 Noted on d.s. Face

Damage to slopes or top of dam _____

Cracked or Damaged Masonry Gunite Treatment is spalling off Spillway Surface

Evidence of Seepage Just West of Spillway @ d.s. Toe

Evidence of Piping _____

Erosion _____

Leaks Flow is into Spalled Spillway & out of d.s. toe 18" Vert Spillway Wier fac

Trash and/or debris impeding flow _____

Clogged or blocked spillway _____

Other UPSTREAM face needs additional R.P.P.

12. Remarks & Recommendations: (fully explain)

Notify City To Rectify foregoing deficiencies.
Since The City Should Have a Consultant Inspect Scott
and Lovell Reservoirs, and Since There is Seepage ^{But not indicative}
in evidence at this dam it may be desirable ^{to}
have this Consultant inspect this dam.

13. Overall Condition:

1. Safe _____
2. Minor repairs needed ☒ _____
3. Conditionally safe ^{to} - major repairs needed ☒ _____
4. Unsafe _____
5. Reservoir impoundment no longer exists (explain) -
Recommend removal from inspection list _____

DESCRIPTION OF DAM

DISTRICT 3

Submitted by W. REGAN Dam No. 3-14-332-19
Date 5/28/75 City/Town WESTMINSTER
Name of Dam Meetinghouse Pond

1. Location: Topo Sheet No. 19C

Provide 8 $\frac{1}{2}$ " x 11" in clear copy of topo map with location of Dam clearly indicated.

2. Year built: 1893 Year/s of subsequent repairs N/A

3. Purpose of Dam: Water Supply ☒ Recreational _____
Irrigation _____ Other _____

4. Drainage Area: 1.5 ± sq. mi. _____ acres

5. Normal Ponding Area: 155 acres; Ave. depth _____
MAX DRAW = 15'
Impoundment: 655 million gals.; _____ acre ft.

6. No. and type of dwellings located adjacent to pond or reservoir
15 ± Residences i.e. summer homes, etc. 1 Pumping Station

7. Dimensions of Dam: Length 150' ± Max. Height 10' ±

Slopes: Upstream Face See Sketch

Downstream Face 2:1

Width across top See Sketch

8. Classification of Dam by Material:

Earth ☒ Conc. Masonry _____ ^{GUNITED} Stone Masonry ☒

Timber _____ Rockfill _____ Other RIP RAP U.S. FACE

9. A. Description of present land usage downstream of dam:

100 % rural; _____ % urban.

B. Is there a storage area or flood plain downstream of dam which could accomodate the impoundment in the event of a complete dam failure? yes _____ no _____

See Note for (10)

10. Risk to life and property in event of complete failure.

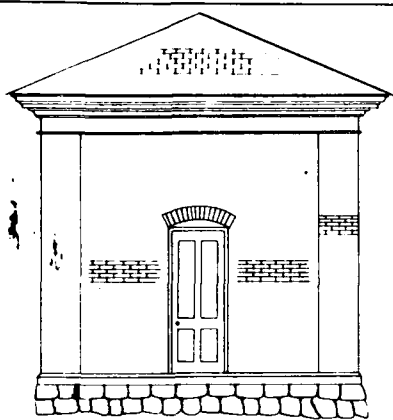
See Note
below

No. of people _____.
 No. of homes _____.
 No. of Businesses _____.
 No. of industries _____ Type _____
 No. of utilities _____ Type _____
 Railroads _____.
 Other dams _____.
 Other _____

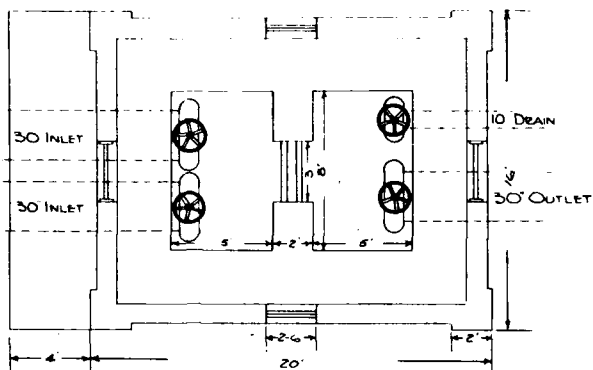
11. Attach Sketch of dam to this form showing section and plan on 8 1/2" x 11" sheet.

12. How to Locate: ^{Rte.} 140 N.B. Westminster. Turn LT. onto old Worcester Rd ('T' intersection). TRAVEL 1/2 mile To a point 450'± N. of Brick Gate House, where Stream crosses Rd through a Stone Box Culv. Head Upstream on Foot to dam

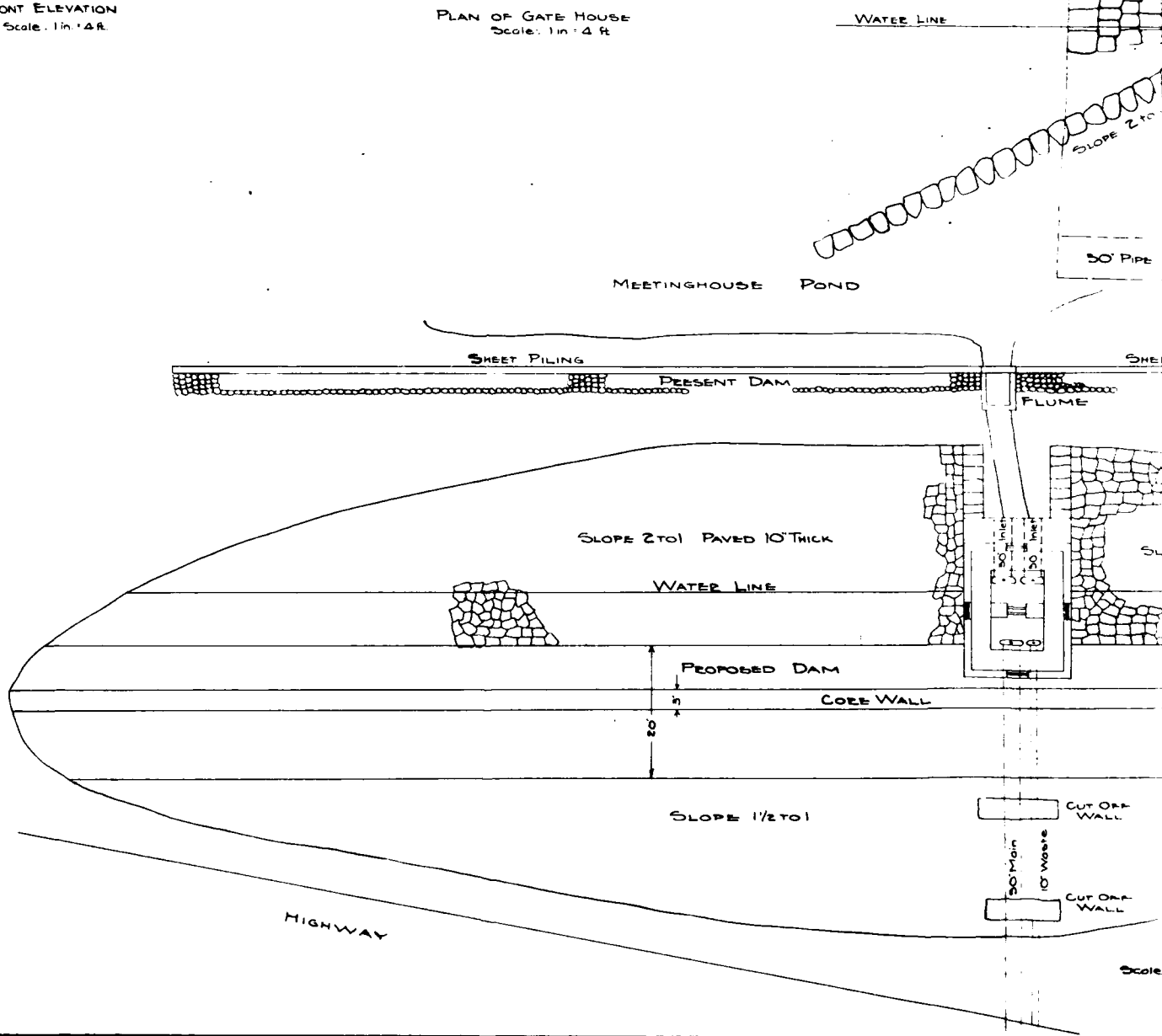
Note (10): The failure passes through a 2' H x 4' V GRAN Box Culv just D.S. on old Princeton Rd. Its highly probable that this road would wash out. AFTER THIS LOCATION, The failure discharge passes through an 0.8± mile undeveloped stretch and then under Rte. 140 through a bridge built after the '55 Flood. Property damage to same is Probable. IT THEN PASSES over Dam No. 3-14-332-13 and damage to same (Poss. Complete Failure) is Probable. 1/2± beyond this Storage is reached in Wyman Pond. In the event of an exceptional Storm it's a Possibility that the Elev. of Wyman Pond could be raised sufficiently to cause property damage at scores of shoreline residences

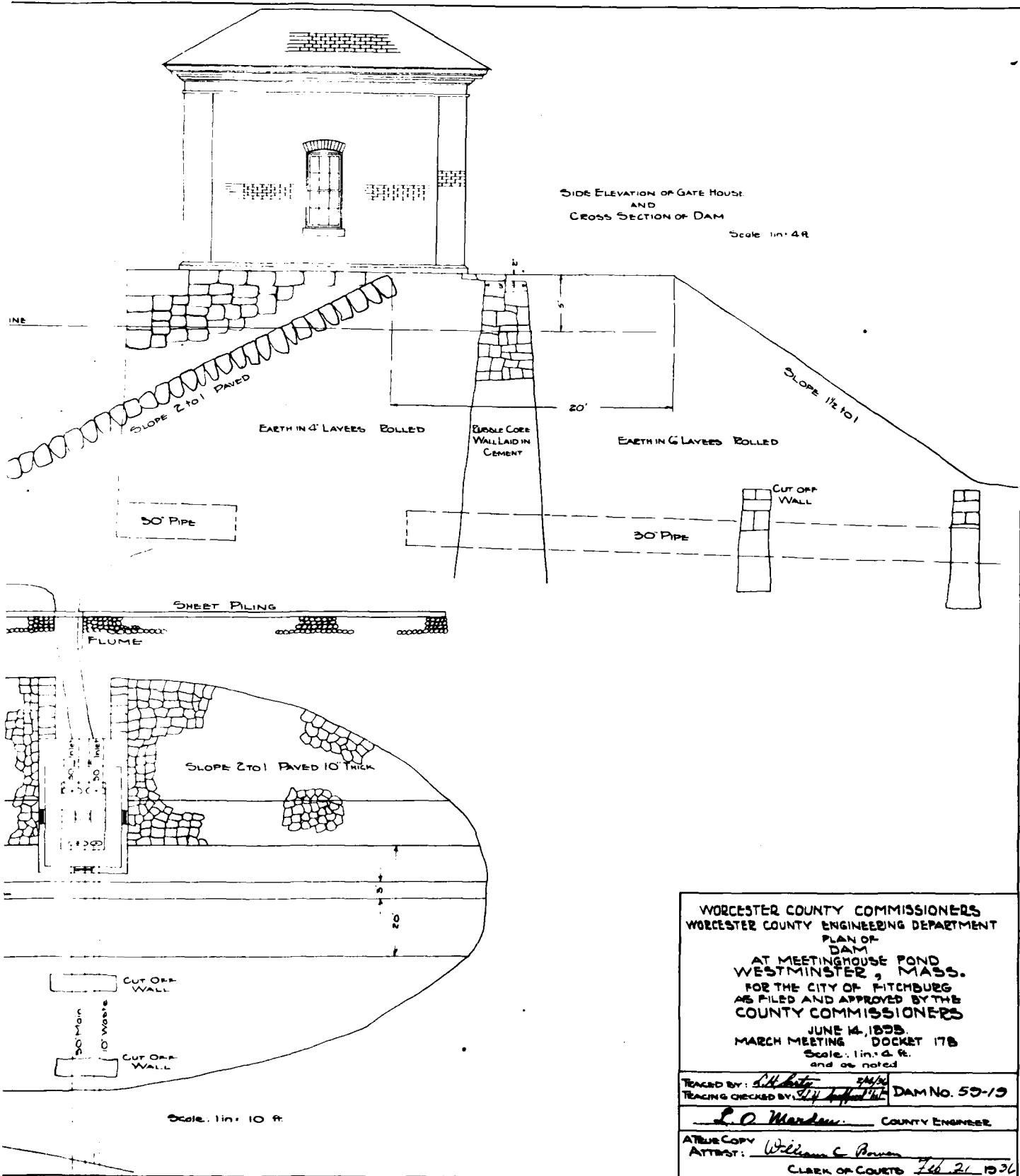


FRONT ELEVATION
Scale: 1 in. = 4 ft.



PLAN OF GATE HOUSE
Scale: 1 in. = 4 ft.

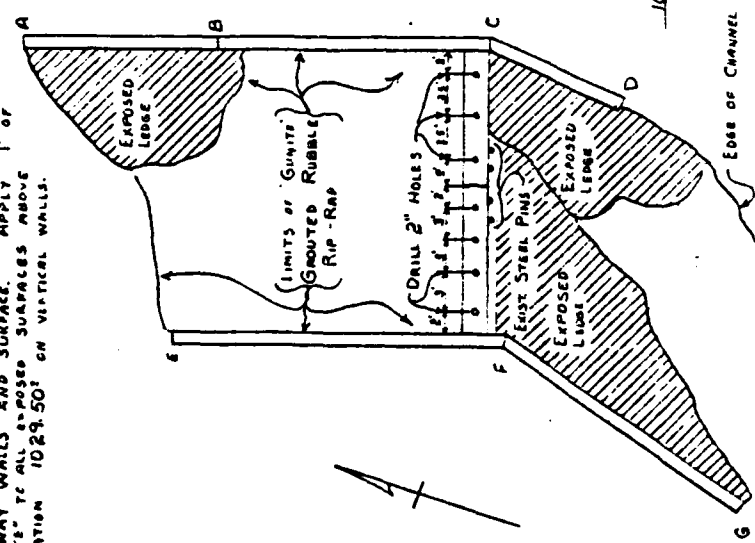




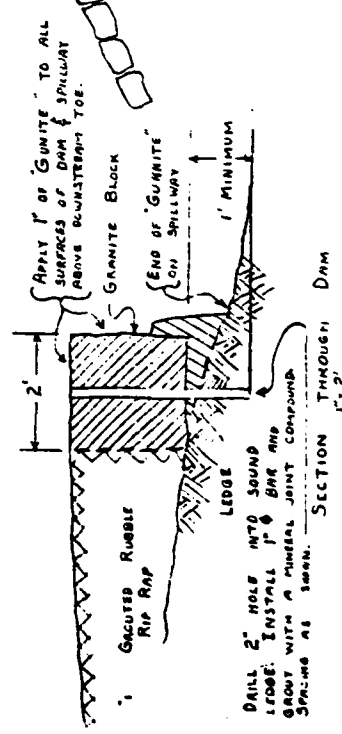
1026.62

WINGWALLS & SPILLWAY

REMOVE ALL VEGETATION AND LOOSE MORTAR FROM SPILLWAY WALLS AND SURFACE. APPLY 1" OF "GUNITE" TO ALL EXPOSED SURFACES ABOVE ELEVATION 1029.50' ON VERTICAL WALLS.

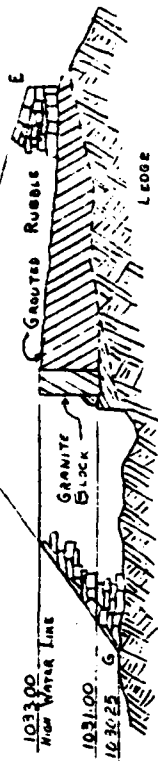


SPILLWAY PLAN
1" = 10'

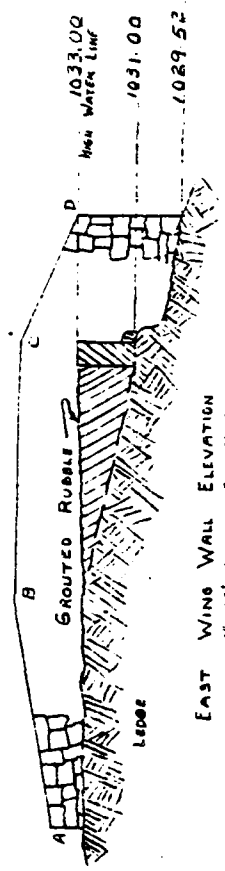


DRILL 2" HOLE INTO SOUND LEDGE. INSTALL 1" x 6 BAR AND GROUT WITH A MINERAL JOINT COMPOUND SPACING AS SHOWN.

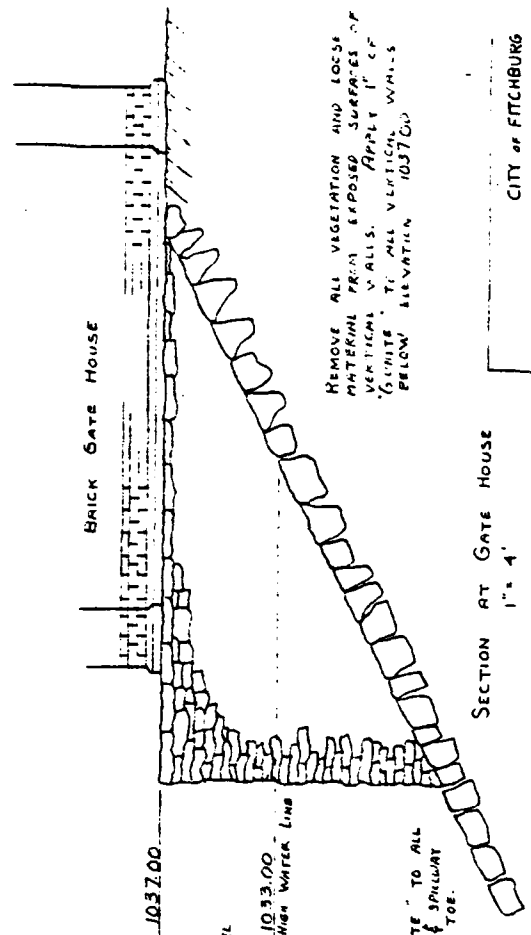
SECTION THROUGH DAM
1" = 2'



WEST WING WALL ELEVATION
1" = 10' HOR 1" = 4' VERT



EAST WING WALL ELEVATION
1" = 10' HOR 1" = 4' VERT



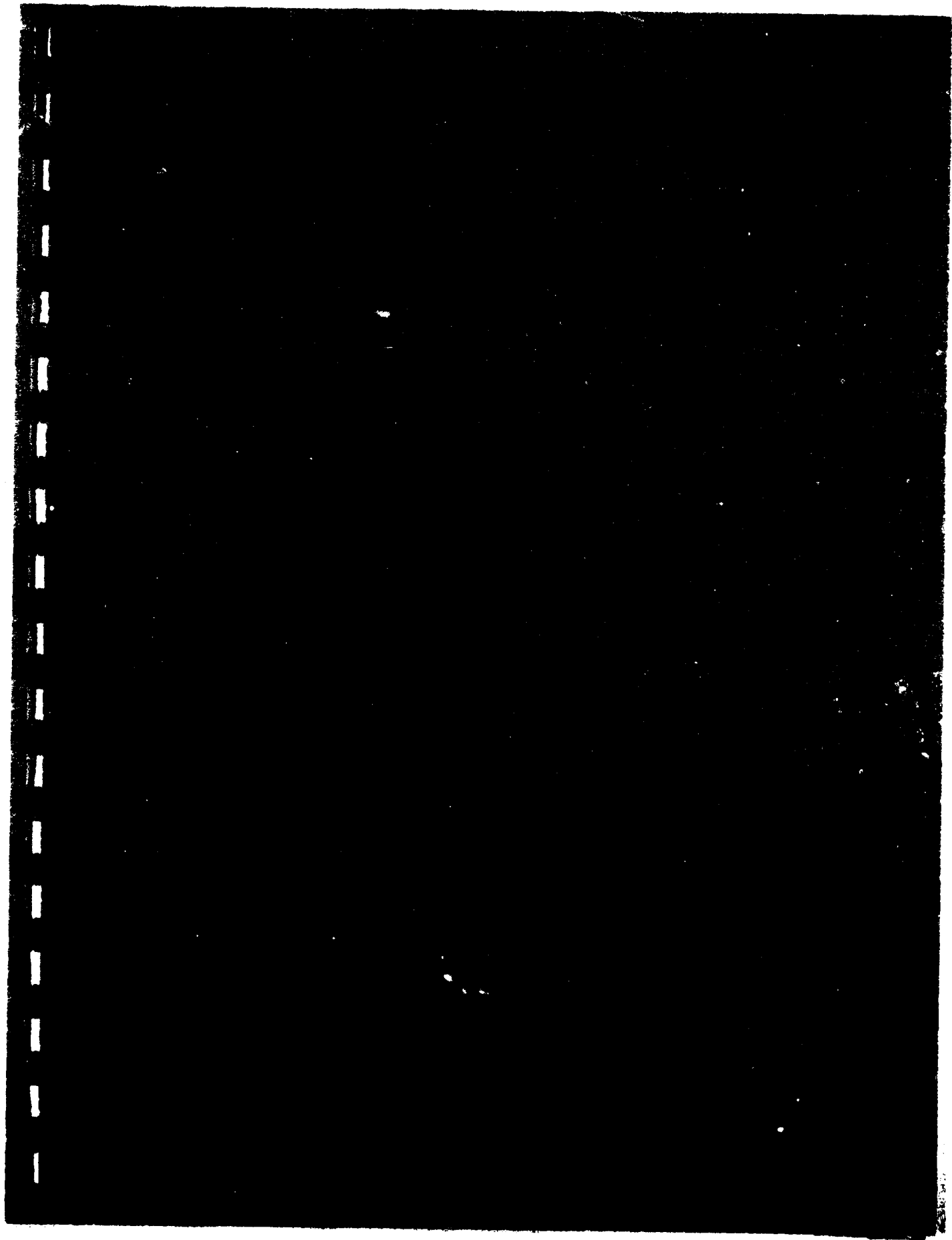
SECTION AT GATE HOUSE
1" = 4'

REMOVE ALL VEGETATION AND LOOSE MATERIAL FROM EXPOSED SURFACES OF VERTICAL WALLS. APPLY 1" OF "GUNITE" TO ALL VERTICAL WALLS BELOW ELEVATION 1037.00

NOTE: THE CONTRACTOR SHALL TAKE ALL NECESSARY PRECAUTIONS TO PREVENT DEBRIS FROM CLEANING OR "GUNITING" OPERATIONS FROM ENTERING WATER MAIN INLET AT GATEHOUSE.

CITY OF FITCHBURG
DEPARTMENT OF PUBLIC WORKS
ENGINEERING DIVISION
REPAIRS TO MEETINGHOUSE SPILLWAY AND GATEHOUSE

SCALE: AS SHOWN 1" = 8'

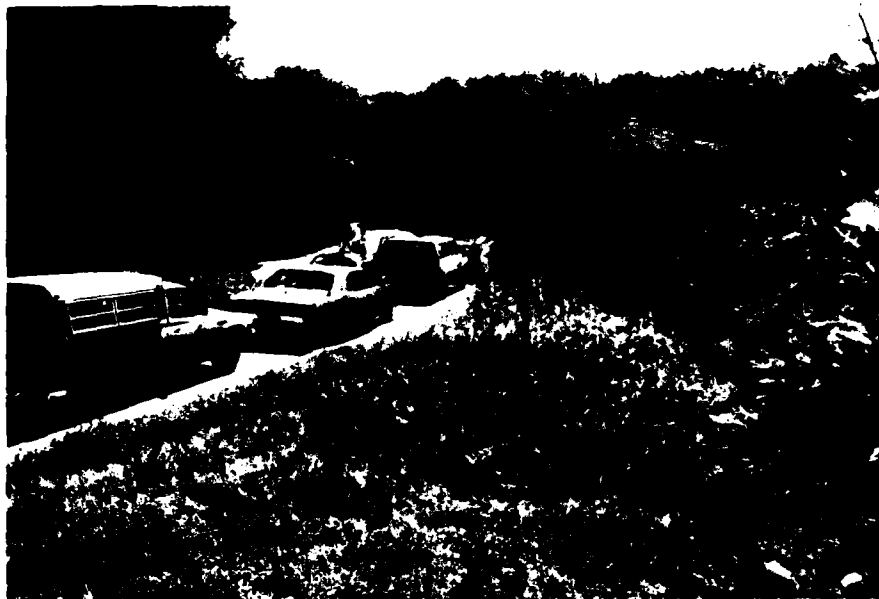




2. DAM RIGHT EMBANKMENT AND GATE HOUSE.



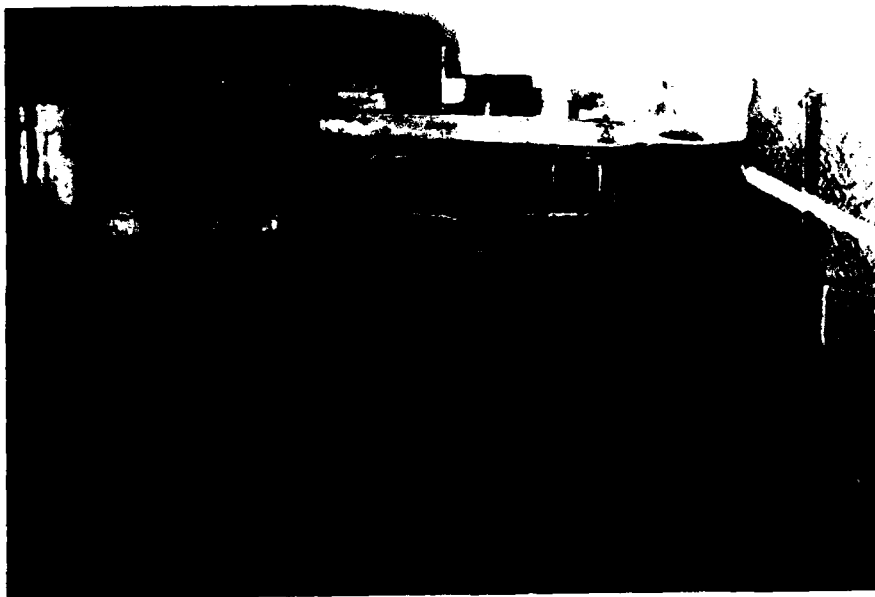
3. INTAKE CHANNEL TO GATE HOUSE.



4. CREST OF LEFT DAM EMBANKMENT AND GATE HOUSE.



5. VIEW OF LEFT DAM EMBANKMENT FROM ROAD DOWNSTREAM
AND PARALLEL TO DAM.



6. FRONT VIEW OF MECHANICAL BAR SCREEN CLEANER
INSIDE GATE HOUSE.



7. MECHANICAL BAR SCREEN MOTOR OPERATOR
AND REAR OF BAR SCREEN CLEANER HOUSING.



8. BLOWOFF PIPE VALVE STEM DOWNSTREAM OF DAM.



9. BLOWOFF PIPE OUTLET.



10. APPROACH VIEW OF SPILLWAY.



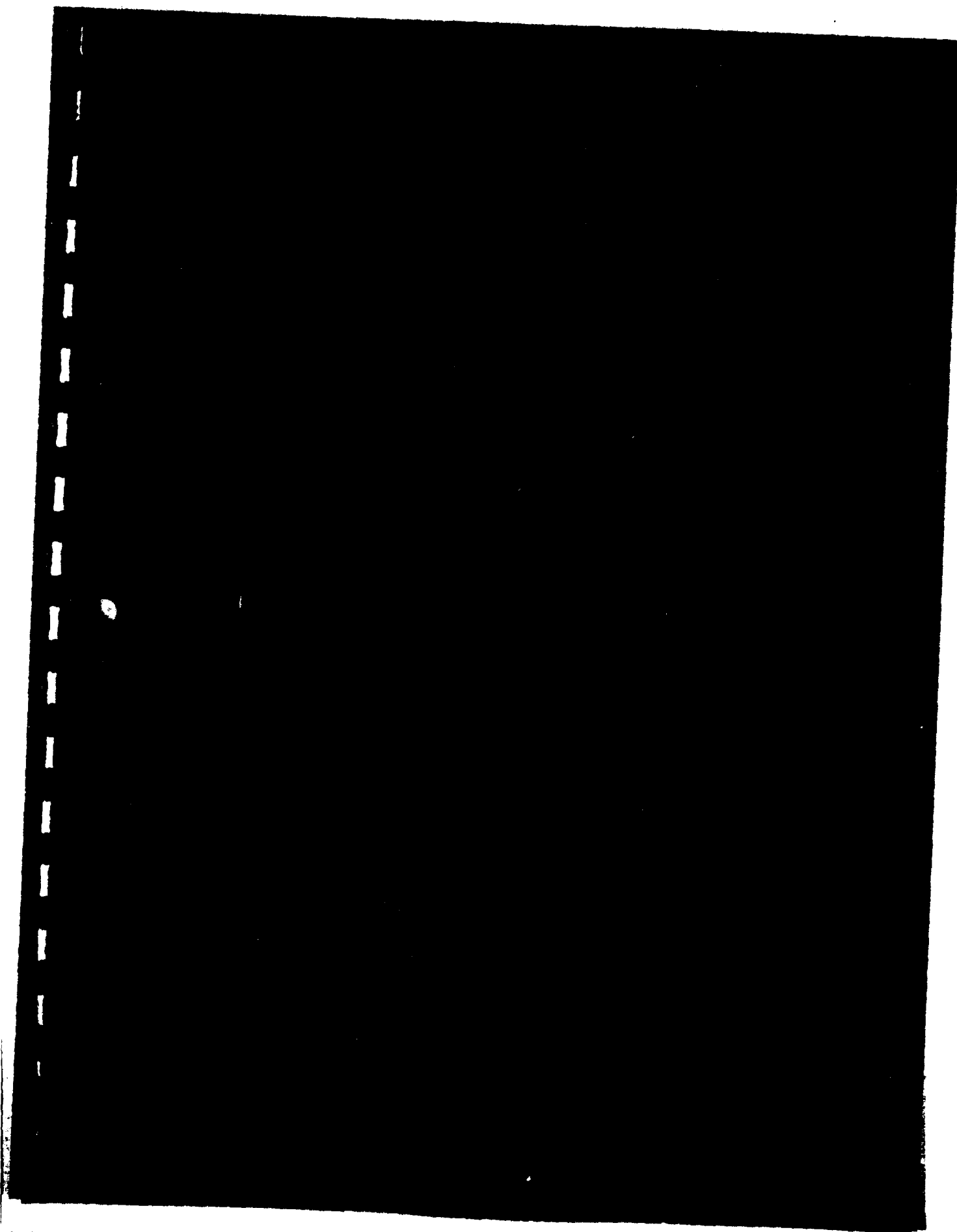
11. DOWNSTREAM FACE OF SPILLWAY AND FLASHBOARDS
WITH POND IN BACKGROUND.

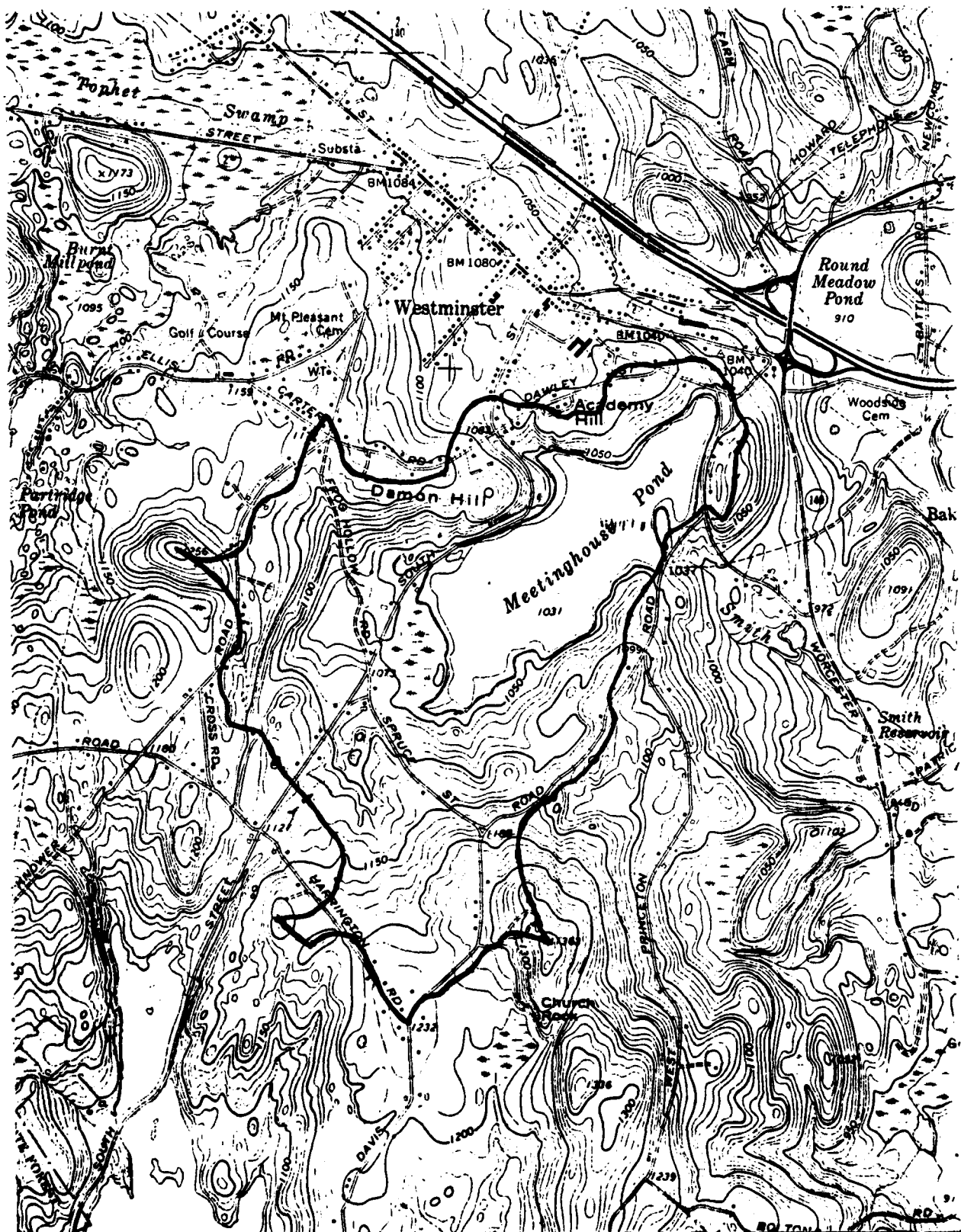


12. SPILLWAY LEFT APPROACH WALL.



13. SPILLWAY RIGHT APPROACH WALL.





CAMP DRESSER & McKEE Inc.
Consulting Engineers
Boston, Mass.



MEETINGHOUSE POND DAM
DRAINAGE AREA MAP
SCALE: 1" = 2000'

APPENDIX D-1

ELEVATIONS

Plans & sketches report spillway crest @ 1033.0 and top of dam @ gate house @ 1037.0. Levels made by City Eng'r Dept. @ the request of CDM project: spillway = 1032.43 and top of dam @ G.H. = 1037.53; difference = 5.2 ft.

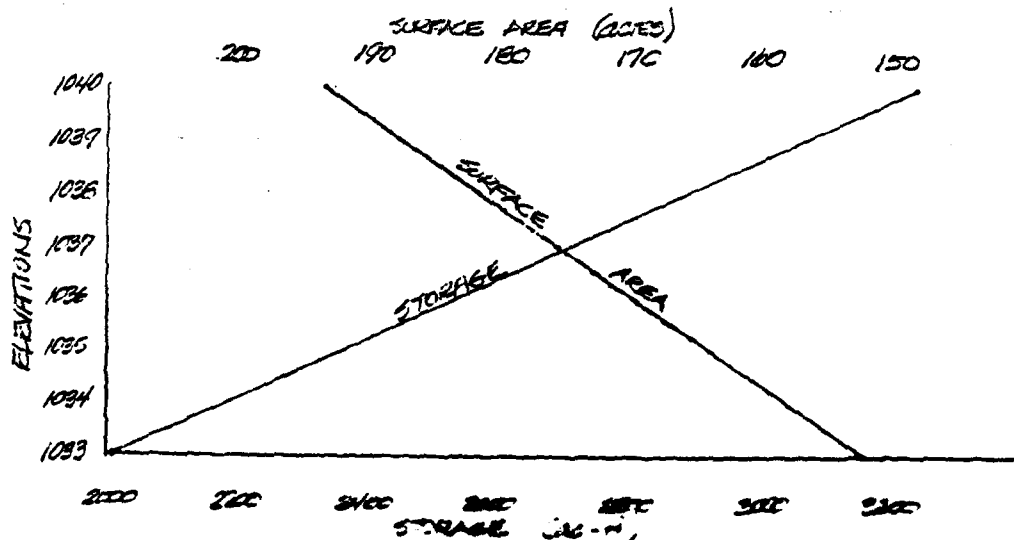
USC: SPILLWAY CREST = 1032.0; TOP OF DAM @ G.H. = 1032 + 5.2 = 1037.2
EMBANKMENTS ADJACENT TO SPILLWAY: RIGHT = 1033 + 4 = 1037.0
LEFT = 1033 + 3 = 1036.0
TOE OF SPILLWAY = 1029.5 (from plans)

SURFACE AREAS

At El. 1033.0 = 152.7 acres (from City records)
At El. 1040 = 193.6 acres
At El. 1050 = 265.4 acres } from USGS records

STORAGE CAPACITIES

At Spillway Crest El. 1033.0 = 655,000,000 gals / 325,851 = 2,010 ac.-ft.
(from City Records)
At El. 1040, $2,010 + ((193.6 + 152.7) / 2) \times 7 = 2,010 + 1,213 = 3,223$ ac.-ft.



SIZE CLASSIFICATION

HYDRAULIC HEIGHT: Top of Embankment Right of Spillway = 1037.0
Toe of Spillway = 1029.5
7.5 ft.

STORAGE CAPACITIES:

@ Elev. 1035.0 = 2,300 cu-ft.
@ Elev. 1031.0 = 2,700 cu-ft.

∴ Size classification, based on storage, is INTERMEDIATE

HAZARD CLASSIFICATION

Discharges from Meetinghouse Pond are conveyed approx. 1.5 miles by Smith Brook to Wymann Pond. There are three diversions and one extremely small pond between the diversion and Wymann Pond. Existing development is located only along Federal Road, the last of the three diversions. Existing development consists of 2 to 4 homes which might experience minor water damage in the event of a dam failure.

∴ hazard classification is a "low" - SIGNIFICANT

TEST FLOOD

INTERMEDIATE size & SIGNIFICANT hazard → 1/2 PMF to PMF range.

Since the size is a "small" - Intermediate and the hazard is a "low" - Significant, the 1/2 PMF will be adopted as the TEST FLOOD

DRAINAGE AREA

The 1.47 sq. mi. drainage area (from city records) is sparsely developed and heavily wooded. The terrain is steep to rolling.

Meetinghouse Pond (152.7 acres surface area) is 216% of the total D.A.

POTENTIAL MAXIMUM FLOOD (PMF)

Peak inflow from extrapolation of CCE 3.75CS, mid-range between RELLINE & MOUNTAINOUS TERRAIN IS 2450 CFS.

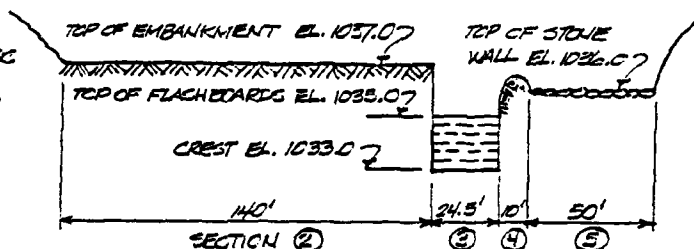
$$\text{THEN PMF INFLOW} = 2450 \text{ CFS} \times 1.47 \text{ mi}^2 = 3,600 \text{ CFS}$$

$$\frac{1}{2} \text{ PMF INFLOW} = 3600 / 2 = 1,800 \text{ CFS}$$

STAGE - DISCHARGE RELATIONSHIPS

$Q = CLH^{3/2}$; Let C = 3.3 for concrete spillway; 3.5 for sharp crested flashboards; 3.1 for earth and rock embankments with trees and vegetation and 2.5 without trees or vegetation

SECTION ① =
Dam & Gate House
L = 220 ft.
crest EL. 1038.2



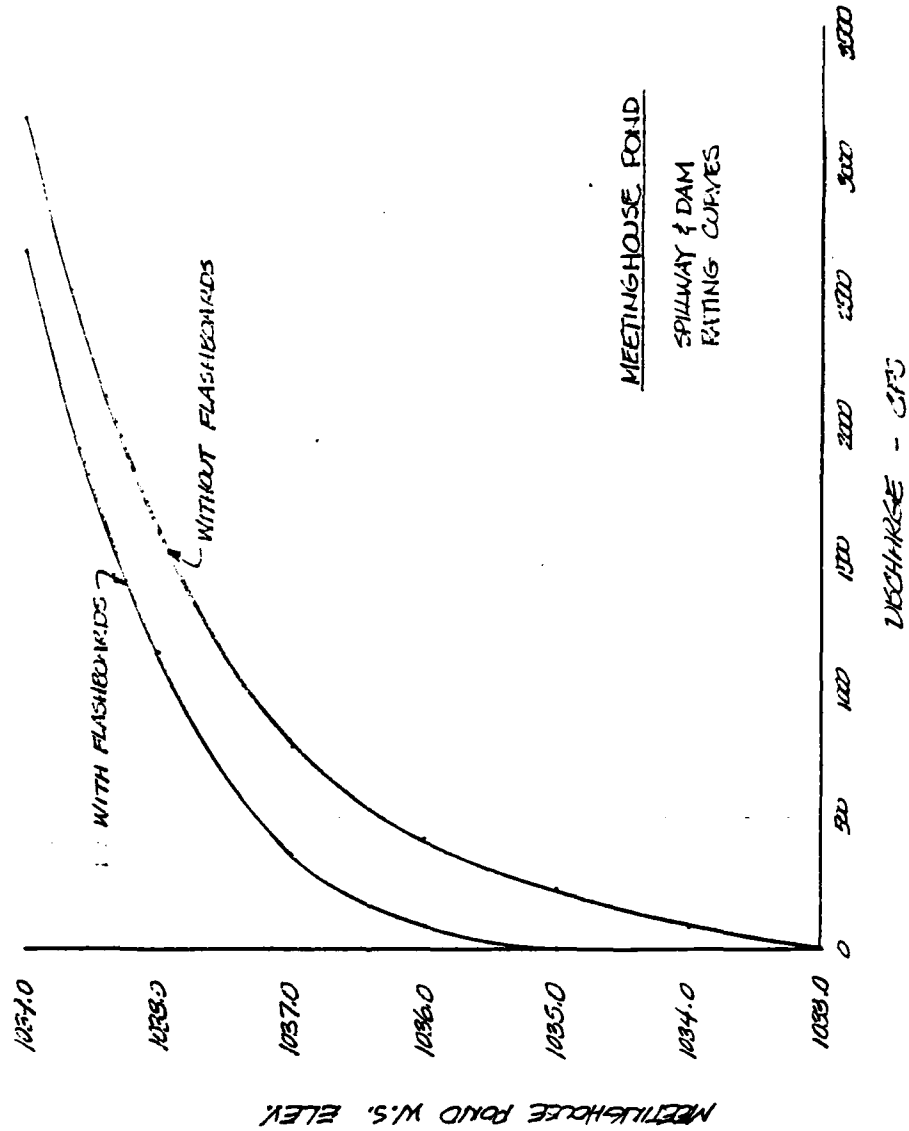
ELEVATION	① C=2.5	② C=2.2	③ C=3.3/3.5	④ C=2.2	⑤ C=2.2	TOTAL wq/w flash.
1033.0	-	-	0/-	-	-	0/-
1034.0	-	-	81/-	-	-	81/-
1035.0	-	-	229/0	-	-	229/0
1036.0	-	-	420/86	0	0	420/86
1037.0	-	0	647/243	11	110	766/364
1038.0	-	306	904/446	62	311	1585/1127
1039.0	411	871	1186/666	114	572	3156/2654

CAMP DRESSER & McKEE
Environmental Engineers
Boston, Mass

CLIENT _____
PROJECT _____
DETAIL MEETINGHOUSE POND

JOB NO 380-S-116
DATE CHECKED 10-28-79
CHECKED BY Miller

PAGE 4 of 8
DATE 10-6-79
COMPUTED BY JED



APPENDIX D-5

SURCHARGE - STORGE ROUTING (Without Flashboards)

$$Q_1 = 1/2 \text{ PMF INFLOW} = 1,800 \text{ cfs}$$

$$\text{Surcharge Ht}_1 = 1035.0 + (1800 - 1585) / (3150 - 1585) \times 1.0 \\ = 1035.0 + 0.14 = 1035.14$$

$$\text{STOR}_1 \text{ @ EL. } 1035.14 = (3223 - 2210) / 7 \times (1035.14 - 1033.0) \\ = 173.3 \times 2.14 = 370.8 \text{ ac-ft.}$$

$$\text{then STOR}_1 = 370.8 / (53.3 \times 1.47) = 11.4 \text{ inches}$$

$$Q_{P2} = 1800 \times (1 - 11.4 / 9.5) = 1800 \times (>1) \rightarrow \text{Say } Q_{P2} = 0$$

$$\text{then Surcharge Ht}_2 = 1033.0$$

$$\text{STOR}_2 \text{ @ EL. } 1033.0 = 0$$

$$\text{AVE. STOR.} = (0 + 370.8) / 2 = 185.4 \text{ ac-ft.}$$

$$\text{Surcharge Ht}_3 \text{ @ } 185.4 \text{ ac-ft STOR} = 445.4 / (3223 - 2210) \times 7 + 1033.0 \\ = 0.27 \times 7 + 1033.0 \\ = 1035.57, \text{ say } 1035.6$$

$$\text{then } Q_{P3} = (420 - 229) \times 1.6 + 229 = 344 \text{ cfs}$$

$$\text{Say } 1/2 \text{ PMF OUTFLOW} = 350 \text{ cfs}$$

SPILLWAY CAPACITIES

@ Test Flood EL. 1035.57, without flashboards:
 $(420 - 229) \times 1.6 + 229 = 344 \text{ cfs} \rightarrow 350 \text{ cfs} \checkmark$

@ Test Flood EL. 1035.57, with flashboards:
 $86 \times 1.57 = 149 \text{ cfs}, \text{ say } 20 \text{ cfs}$

Revised
11-30-76
JED

TAILWATER ANALYSIS

Tailwater elevations will be controlled by downstream
culvert @ West Princeton Road. See field sketch, next page.

Top of Road El. $1033 + 2.0 - 24" = 1025.0$

Culvert opening: $36" W \times 45" H$

$I.W. = 1025.0 - 3'6" - 4'5" = 1020.75$
 $A_{122} = 3' \times 3.75' = 11.25 \text{ ft}^2$

1. Let W.S. = El. 1025.0 (Top of Road)

$Q = CA(2gh)^{1/2} = (0.6)(11.25)(2 \times 22.2 \times 3.5)^{1/2} = 135 \text{ cfs}$

2. Let W.S. = El. 1029.0

$Q = (0.6)(11.25)(64.4 \times 4.5)^{1/2} + (2.5)(137)(1)^{3/2}$
 $= 153 + 242 = 495 \text{ cfs}$

3. Let W.S. = El. 1029.5

$Q = (0.6)(11.25)(64.4 \times 5)^{1/2} + (2.5)(174)(1.5)^{3/2}$
 $= 161 + 806 = 967 \text{ cfs}$

4. Let W.S. = El. 1030.0

$Q = (0.6)(11.25)(64.4 \times 5.5)^{1/2} + (2.5)(214)(2)^{3/2}$
 $= 167 + 1513 = 1680 \text{ cfs}$

Then stage @ Test Flood (340 cfs) is

$(340 - 125) / (495 - 125) \times 1.0 + 1025.0 = 1028.57$
@ W. Princeton Rd.

Final #1

Assume EGL slope equals slope from top of culvert + 5' to
W.S. El. @ W. Princeton Rd. Culvert.

@ Tailwater El. 1034.50

@ Culvert El. 1025.00

$4.5 \text{ ft} \div 275' (\text{culvert to channel}) = 0.0164$

Channel bottom ~ 25' wide, $R = 0.025$, fine approx.

$Q = 340 = \frac{1.49}{0.025} \times (25)^{2.49} \times \left(\frac{250}{25 \times 25} \right)^{5/3} \times (0.0164)^{1/2}$

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DETAIL MEETINGHOUSE ROAD

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PAGE 7 of 8
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$$Q = 340 = 1.48 (4) (25 / 25 + 24)^{2/3}$$

$$1.76 = (4) (25 / 25 + 24)^{2/3}$$

$$\text{let } y = 2 \text{ ft.}$$

$$(2) (25 \times 3 / 25 + 2 \times 3)^{2/3} = (3) (16) = 5.4 > 1.76$$

$$\text{let } y = 1 \text{ ft.}$$

$$(1) (25 \times 1 / 25 + 2 \times 1)^{2/3} = 0.95 < 1.76$$

$$\text{let } y = 1.5 \text{ ft.}$$

$$(1.5) (25 \times 1.5 / 25 + 2 \times 1.5)^{2/3} = 1.59 < 1.76$$

$$\text{at } 340 \text{ cfs, } y = (1.76 - 1.59) / (5.4 - 1.59) \times (3 - 1.5) + 1.5 = 1.57 \text{ ft.}$$

$$\text{W.S. \& Toe of Spillway} = 1029.5 + 1.6 = 1031.1$$

$$\text{Velocity} = 340 / 25 \times 1.6 = 8.5 \text{ fps}$$

$$V^2/2g = (8.5)^2 / 64.4 = 1.12$$

$$\text{EGL} = 1031.1 + 1.12 = 1032.22 \text{ \& Toe of Spillway}$$

$$\text{EGL \& W. Protection Rd.} = 1026.0 + 5.57 \times 3/4 = 1028.66$$

$$\text{Then New EGL Slope} = (1032.22 - 1028.66) / 5.15 = 0.672$$

SPILLWAY W.S.
with 0.6764

$$\therefore \text{TRUNKWATER ELEV. \& Spillway Toe} = 1031.1$$

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Boston, Mass

CLIENT CCE
PROJECT NAT'L DAM INSP
DETAIL WATERGATE 2162

JOB NO 88-5-11
DATE CHECKED 10-2-78
CHECKED BY OFFER

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Revised
11-30-78
JED

DAM FAILURE ANALYSIS

Assume 40% Breach Width (W_b) of embankment to
right of spillway

$$W_b = 140 \text{ ft.} \times 40\% = 56 \text{ ft.}$$

$$Y_o = 1037.0 - 1029.5 = 7.5 \text{ ft.} - \text{use } 7 \text{ ft.}$$

$$Q_p = 5/47 \times 56 \times (32.2)^{1/2} (7)^{3/2} = 1,750 \text{ cfs}$$

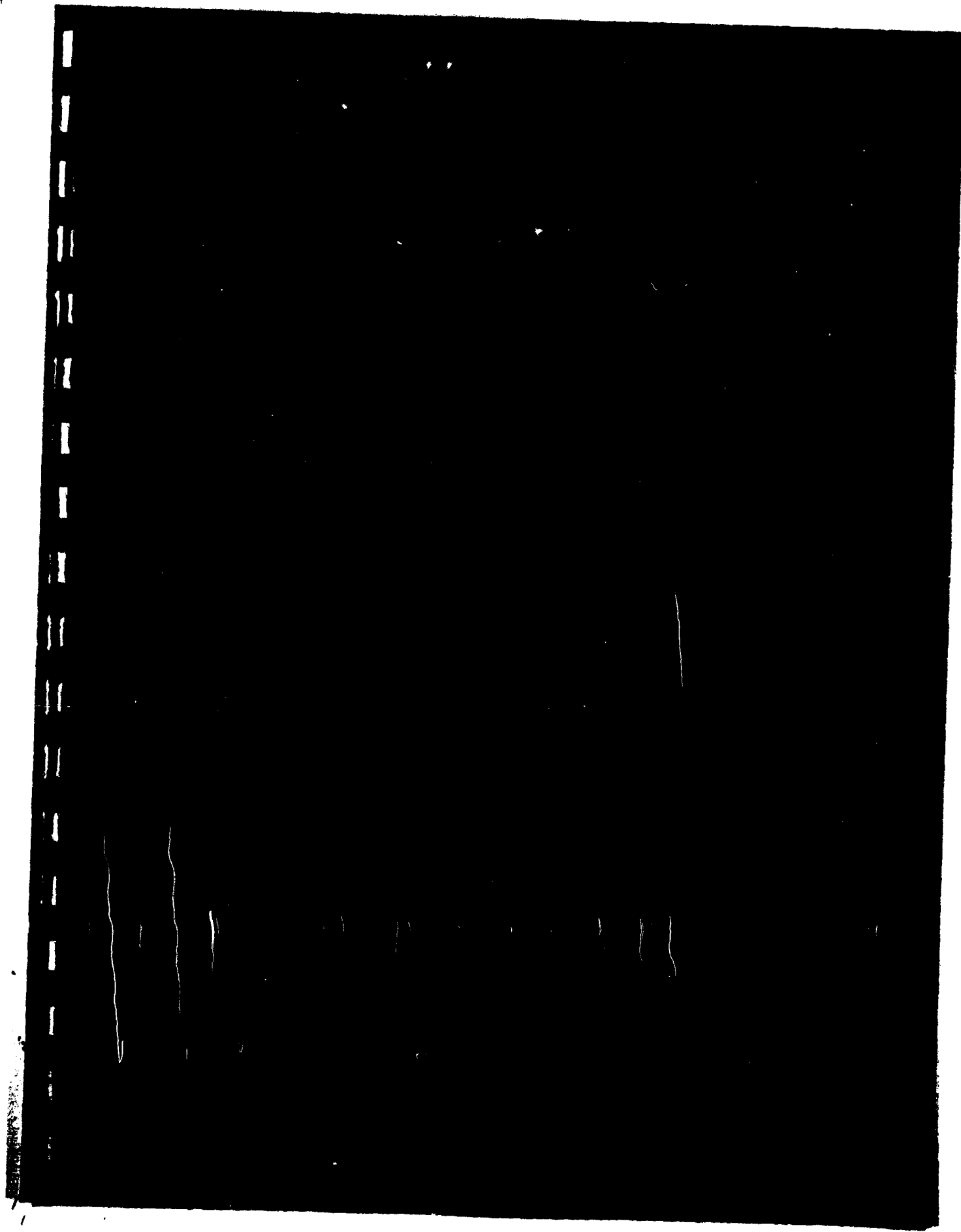
From Tailwater Analysis, West Worcester Rd. will
be overtopped by more than 2 ft. of water.

The remaining culverts between the dam site
and Worcester Rd. are also inadequate to pass
a peak discharge of 1,750 cfs. These include:

1. Old Rt. immediately up of Worcester Rd. (Ref. 140)
4 ft. wide x 4.5 ft. high corr. culvert, $L = 45'$
2. Worcester Rd. (Ref. 140)
75" of corr. culvert, $L = 80'$
3. Patricia Ri.

Small, unmeasured S.M.P.

Existing development which might be affected by
overtopping of culverts is limited to 2 to 4
residences along Patricia Rd.





INVENTORY OF DAMS IN THE UNITED STATES

IDENTITY NUMBER	STATE	COUNTY	CITY	COUNTY	NAME	LATITUDE (NORTH)	LONGITUDE (WEST)	REPORT DATE DAY MO YR
MA 1010	MA	027	04		MEETINGHOUSE POND DAM	4232.0	7154.3	22AUG70

POPULAR NAME	NAME OF IMPOUNDMENT			
	MEETINGHOUSE POND			
REGION/DAM	RIVER OR STREAM	NEAREST DOWNSTREAM CITY - TOWN - VILLAGE	DIST FROM DAM (MI.)	POPULATION
01 05	SHITH BROOK	WESTMINSTER	0	4525

TYPE OF DAM	YEAR COMPLETED	PURPOSES	STATUS	HYDRAULIC HEIGHT (FT.)	IMPOUNDING CAPACITIES (ACRES-FT.)	DIST OWN	FED R	PRV/FED	SCS A	VER/DATE
RECTPG	1893	8	6	7	2010	NED	N	N	N	40EC70

REMARKS

O/S HAS LENGTH	SPILLWAY	MAXIMUM DISCHARGE (CFS)	VOLUME OF DAM (CUY)	POWER CAPACITY (KW)	INSTALLED	PROPOSED	NO.	LENGTH	WIDTH	LENGTH	WIDTH	LENGTH	WIDTH
1	225	25	420										

OWNER	ENGINEERING BY	CONSTRUCTION BY
CITY OF FITCHBURG	CHARLES A ALLEN CONSULT	

DESIGN	CONSTRUCTION	OPERATION	MAINTENANCE
NONE	NONE	NONE	NONE

INSPECTION BY	INSPECTION DATE DAY MO YR	AUTHORITY FOR INSPECTION
CAMP DRESSER + MCKEE INC	22AUG70	PL 92-367

REMARKS

DATE
FILMED
-8